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FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY. R--ETC(U)

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UNCLASSIFIED HEC-TD-9-REV NL

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FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY SEPTEMBER 1977

(12)

LEVEL II

TRAINING DOCUMENT NO. 9

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY

SEPTEMBER 1977

HEC

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TRAINING DOCUMENT

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION

HEC-1 CAPABILITY

October 1974

(Revised September 1977)

by

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INTRODUCTION

HEC-1 has been augmented to provide the capability of automatically determining the sizes of flood control system measures that result in maximizing total system net economic benefits subject to possible hydrologic performance targets. The system flood control measures that can be automatically sized are:

- Detention storage reservoir(s)
- Pumping plant(s)
- Diversion(s)
- Local protection(s), i.e., channel modification, levee, floodwall

This document presents detailed illustrated examples of facility optimization using HEC-1. The examples are designed to assist in data assembly and coding, output interpretation, and study management.

Examples included are constructed in building block sequence to illustrate the relationships between the hydrologic, economic and cost data and demonstrate selected capability. Examples illustrated include:

1) Hydrologic Model for existing conditions.
2) Economic evaluation of existing conditions.
3) Optimization of Reservoir and Pumping Plant with no hydrologic constraints;
4) Optimization of Reservoir and Pumping Plant with hydrologic performance constraints;
5) Optimization of Reservoir, Pumping Plant and Diversion (unconstrained);
6) Optimization of local protection projects, levee and channel modification (unconstrained); Gr.
7) Optimization of Reservoir, Pumping Plant and local protection projects with uniform local protection level.

The basic reference for HEC-1 is the Users Manual listed as reference 1. The input data supplement, reference 2, updates Addendum 6 of reference 1 to include the facility optimization capability. Technical Paper No. 42, reference 3, describes the conceptual basis for the optimization problem and explains the characteristics of the flood control measures (except for the local protection capability that has recently been added) and a field application. Reference 4 summarizes various optimization algorithms and also includes a list of references pertinent to the subject matter presented herein. Reference 5 describes in detail the methodology involved in the calculation of expected annual damages.

BASIC EXAMPLE DESCRIPTION

The study area lies in the flood plain of a large river and is presently protected (to a degree) by a major levee. The levee greatly restricts outflow from the study area. Most of the storm runoff (within the study area) originates from the higher elevations (bluff areas), and most flooding occurs in the lower reaches of the study streams. Development in the flood hazard areas consists of agricultural crops, industrial-commercial areas and residential development. Figure 1 is a general map and schematization of the example area.

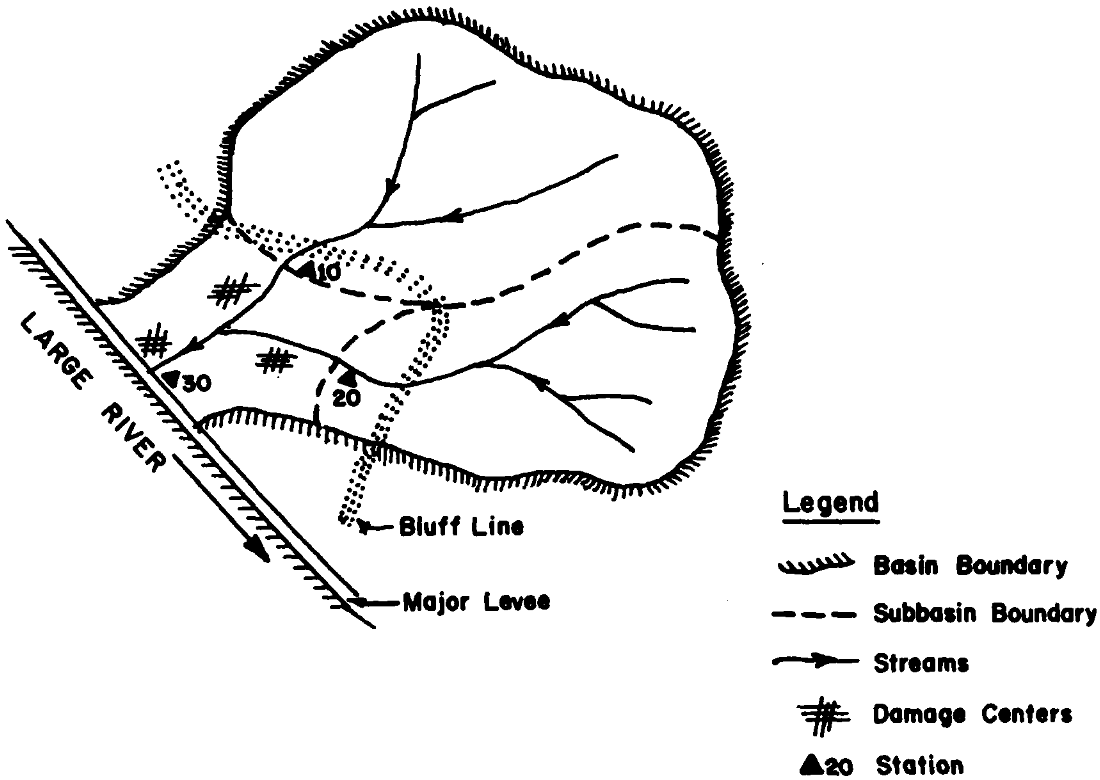
Proposals for protecting vulnerable areas from potential flooding include a detention storage reservoir at station 10, channel modification from station 10 to 30, levee from station 20 to 30, flow diversion (by-pass) from station 20 to 30, and a pumping facility with forebay ponding at the basin outlet, station 30 (see Figure 1-a).

HYDROLOGIC MODEL

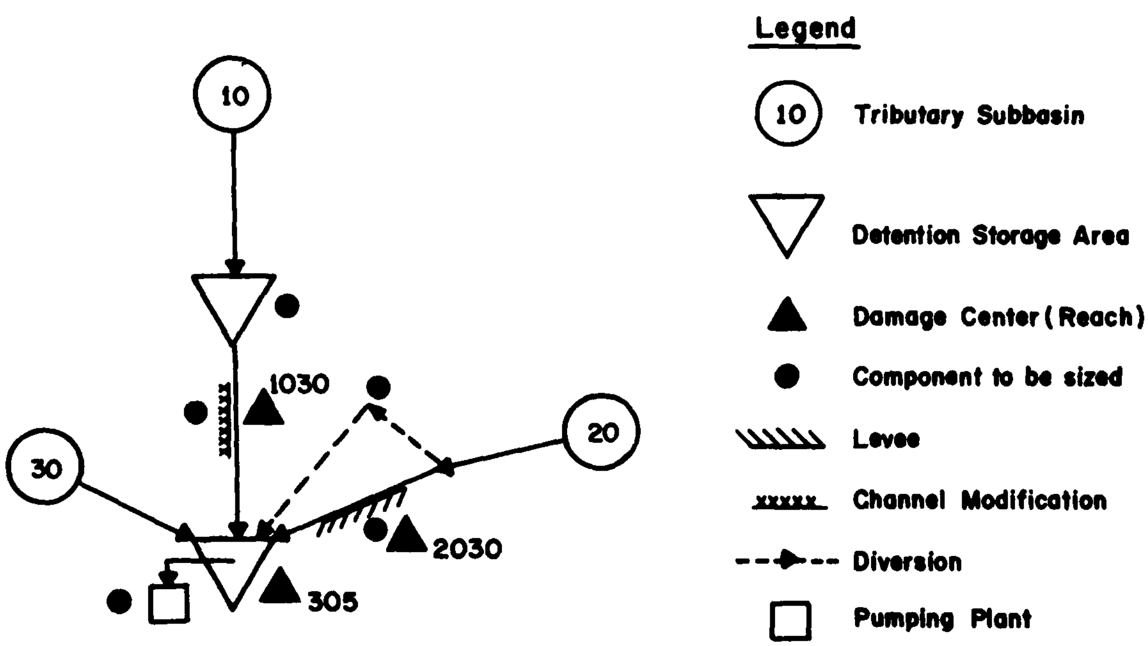
The hydrologic model for existing conditions is needed to define the base hydrology and provide a mechanism for evaluating the performance of proposed alternatives. Care must be taken in developing the base model to assure that all feasible alternatives can be easily evaluated and that the pattern hydrologic event is reasonably representative for the area, i.e., will not bias evaluation of alternatives. Data required for coding the basic hydrologic model is given in reference 1.

Since the primary objective of this supplement is illustration of flood control system component optimization, the hydrologic model has been kept simple in that discharge hydrographs of a specific event are read in rather than computed from rainfall-runoff relations during the optimization. (The hydrographs were essentially computed in a previous run). A hypothetical event was synthesized that ranged in frequency from the annual event (1.0 exceedence frequency) in the upper basin reaches to about the 5-year event (.2 exceedence frequency) in the lower basin. Channel routing criteria has been developed for the streams from multiple water surface profile calculations and for the restricted outlet at station 30 from the geometry of the outflow culvert and local topography. Table 1 (Appendix A) contains a tabulation of the hydrologic data for existing conditions.

Exhibit 1, page 1 of 2, is a listing of the HEC-1 input data for the hydrologic model. The hydrologic simulation of existing conditions indicates that for the selected event, the peak flows at stations 10, 20 and 30 are 5,370 cfs, 5,370 cfs and 10,154 cfs, respectively. The maximum storage level achieved at station 30 is 9,557 ac.ft. (maximum storage at station 30 not shown in computer printout included) and the peak outflow is 1,200 cfs.



a. Study Area



b. Schematic Representation

Figure 1

ECONOMIC EVALUATION—EXISTING CONDITIONS

The economic evaluation for existing conditions provides the base from which economic benefits of alternatives may be evaluated. The economic evaluation of flood damages requires that flow-damage-frequency analysis be performed to develop "expected" (or average) annual damages. Reference 3 and Addendum 3 of reference 1 discuss the general application of flood damage frequency analysis to flood alternative evaluations and describe the concepts embodied in HEC-1.

The information required (in addition to the hydrologic model) is flow (or storage) - damage relationships and exceedence frequency relations at the damage centers. Additional coding is required to set up the multi-plan feature of HEC-1 and establish the range of floods needed to evaluate the hydrologic and economic effects of alternatives.

The damages in reaches 1030 and 2030 are mostly rural and result from overflow from the respective stream channels. Damage surveys have developed relationships between stage and damages for these reaches for a number of categories of damages. Water surface profile studies developed rating curves for the index stations as shown on Figure 1 so that flow-damage functions, as required by HEC-1, could be developed. The damages at location 305 are mostly urban, commercial and industrial (and are thus large) and occur because of ponding behind the levee. In HEC-1 storage is used instead of stage to represent level and thus a storage-damage function has been developed at this site. Storage is analogous to stage and the function is developed from the usual stage-damage relationship and a site stage-storage relationship.

The required exceedence frequency relationships for stations 10 and 20 were based on a partial duration series analysis because significant damages occur from events that occur more frequently than the annual event. These curves were developed from regional relationships developed in other studies. The required frequency relationship for station 30 is storage-exceedence frequency. This function was derived by developing synthetic events that would reproduce the regional curves at station 10 and 20, simulating the hydrologic operation of the system for these events, and plotting the resulting peak storage levels for these events versus their exceedence frequencies. Table 2 (Appendix A) contains the economic and frequency data for the damage centers.

The determination of the range of floods needed requires evaluation of the exceedence frequency relations, base hydrology and damage relations. The objective in developing the range of floods (multi-plan flood ratios) is to provide for automatic revision of the exceedence frequency relationship so that expected annual damages can be computed for alternative proposals. The procedure used for automatically revising the frequency curve is explained in Addendum 3 of reference 1. To accomplish this, the

ratios should develop floods that cover the range of damaging floods at all damage centers; in our example, the range extends from the six times per year event at damage centers 1030 and 2030 to above the .005 event at 305. The ratios contained in Table 2 (Appendix A) when applied to the synthetic event of the hydrologic model adequately cover the range.

The multi-plan coding has been prepared for two plans, which is necessary for the optimization examples following. The two plans are both for existing conditions which is of course redundant. If the multi-plan capability were being applied by itself, coding should be for as many alternatives as is desired for study. Exhibit 2, pages 1 and 2, are a complete listing of data input with notations as to revisions required from the basic hydrologic model and additions for the multi-plan evaluation.

The output for a multi-plan run includes complete hydrologic simulation for existing conditions and the proposed plan of improvement (none for example) for each of the range of runoff events (nine for the example) and integration of the damage relationships. The results indicate expected annual damages under existing conditions are \$33,580, \$33,580 and \$1,110,210 for damage reaches 1030, 2030 and 305, respectively.

The economic output (printout for station 1030 is page 3 of Exhibit 2) begins with a printout of control codes and includes (1) a listing of data input (ECONOMIC DATA FOR STATION 1030 PLAN 1) which includes exceedance frequency in events per year, peak flow and damages, (2) computation of expected annual damages (FLOOD DAMAGES FOR STATION 1030 PLAN 1) which includes allocation of probability intervals (PROB INT) to the range of flood events (FLOW) and incremental computed damage contribution to expected annual damages (SUM, TYPE 1, etc.) that are based on the product of PROB INT and damage associated with FLOW, and (3) the same information for the alternative plan. If the alternative plan had reduced annual damages, then the benefits (AVG ANN BFT) would be positive and equal to the difference between PLAN 1 and PLAN 2.

FLOOD CONTROL MEASURE OPTIMIZATION

The information required in addition to the hydrologic model and multi-plan economic data for flood control measure optimization are the performance parameters and cost relationships for the flood control features being considered. The mathematical structure for the optimization and the search strategy are discussed in detail in reference 3. It should be remembered (or understood) that economic optimum is achieved when the facilities are sized such that the computed difference between expected annual benefits and expected annual costs is maximized. The solution may proceed unconstrained or it can be constrained such that a minimum hydrologic performance at specified control points must be accomplished simultaneously with the net benefit maximization.

The general technique used is to successively operate the multi-plan simulation in a controlled fashion while automatically adjusting component sizes toward optimum.

SIZING RESERVOIR AND PUMPING PLANT — UNCONSTRAINED

The first optimization example will be the determination of the optimum (economic) sizes for a reservoir located at station 10 and a pumping plant to be located at station 30 that discharges through (or over) the levee. There is no minimum constraining hydrologic performance required. Information must therefore be assembled and coded that will describe, in a general way, the cost and performance of the storage reservoir and a pumping facility.

a. Detention Storage. — The detention storage reservoirs that may be considered with HEC-1 are those for which it is possible to define the operating characteristics as unique functions of the storage contents within the reservoirs. A reservoir with an uncontrolled outlet works exactly meets this requirement. To provide capability for automatic adjustment of operating characteristics (as is required for automatic optimization), a reservoir is characterized by (1) the outflow characteristics of a low level outlet, which is defined by the centerline elevation of the outlet and an orifice equation of the form:

$$Q = CA\sqrt{2g}\,(H)^{EXP} \quad \ldots\ldots\ldots\ldots\ldots \quad (1)$$

where

C = orifice discharge coefficient
A = outlet area
H = head on low level outlet
g = acceleration of gravity
EXP = exponent dependent on tailwater conditions, 0.5 if no tailwater

and (2) the overflow characteristics of a spillway which is defined by a weir equation of the form:

$$Q = C_{*}LH_{*}^{\ 3/2} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

where

C_* = weir discharge coefficient
L = length of spillway
H_* = head on spillway

and (3) the site storage characteristics which are defined by an elevation-storage capacity relationship. For an index storage to be optimized, which is the storage at the elevation of the spillway crest, the above relationships are merged to define the reservoir's outflow as a function of the storage level in the reservoir (Modified Puls method of routing).

Two modes are possible for a reservoir optimization. In the usual mode (for our example) a reservoir that can be characterized by a low level outlet and an overflow weir as described above will be automatically adjusted in its index storage capacity, along with all other system components, to achieve the minimum value of the objective function (defined in reference 3). The alternative mode, not illustrated, permits optimization of the size of the low level outlet assuming the reservoir does not spill, which is appropriate for pondage in low lying areas.

The cost relationships for the reservoir in the usual mode consists of a capital cost function and an associated capital recovery factor for converting the capital cost to annual cost, and the annual cost of operation, maintenance and replacement expressed as a proportion of capital cost. The capital cost function includes land acquisition and construction costs, interest during construction, etc., expressed as a function of the index storage size of the reservoir. The capital cost for a specific reservoir size being evaluated during optimization is interpolated from this function and the equivalent annual cost is computed as the product of the capital cost and the capital recovery factor for the appropriate discount rate. The annual cost of operation, maintenance and replacement is the product of the annual cost proportion and the interpolated capital cost. The total annual cost of the reservoir is the sum of these two costs. Table 3 (Appendix A) contains the data describing the performance and cost of the proposed reservoir.

b. Pumping Plant — A pumping facility removes volume from the system at a rate equal to the pumping capacity. The performance characteristics of a pumping plant are defined by an initial threshold water level at which the pump is activated and the discharge capacity of the pumping facility. In this analysis, it is assumed that water pumped from the system does not later appear at other locations in the system. The cost of a pumping facility is computed from a capital cost function and an associated capital recovery factor for converting to equivalent annual cost, the annual operation, maintenance and replacement cost that is a proportion of the capital cost, and the annual power cost. The power cost is adjusted if the volume to be pumped changes as the system components sizes are being optimized. It can be demonstrated that no matter the pumping capacity, the power costs would not materially change if the volume to be pumped does not change. The annual power costs are therefore adjusted only for water that is removed from the system by diversions or other pumping facilities. The annual cost is the sum of the equivalent annual cost, annual operation and maintenance cost, and annual power cost. Table 4 (Appendix A) contains the data describing the performance and cost of the proposed pumping plant.

The coding requires initial estimates for the facility sizes (starting values) and a number of control codes to indicate location and type of facility to be sized. The starting values selected were 10,000 ac.ft. and 4,000 cfs for the reservoir and pumping plant, respectively. Exhibit 3, pages 1 and 2, are a listing of the input data for this example including notations of revisions and additions to the data required for the multi-plan evaluation example.

Exhibit 3, pages 3 - 43, are reproductions of the complete output from the optimization run. The output of an optimization run includes:

1. The derived optimum size for each facility in the system included in the optimization (page 43).

2. Complete hydrologic simulation of the system with and without the optimally sized facilities for the range of floods processed (nine for this example) (pages 6 - 42).

3. Economic expected annual damage analysis with and without the optimally sized facilities for each damage center in the system (pages 17, 24 and 41).

4. Costs for the derived system facilities (pages 11 and 40).

5. A summary of system cost, performance and net benefits (page 42).

The derived optimum sizes are 9,119 ac.ft. for the reservoir and 2,885 cfs for the pumping plant (summary page 43). The total capital cost is $7,497,000 and system annual net benefits are $173,000 (benefit cost ratio of 1.26). The derived values were adjusted from the starting values of 10,000 ac.ft. and 4,000 cfs which corresponded to a capital cost of $8,740,000 and system net benefits of 158,000 (page 43). It is necessary, in each case, to test for possible local optima in the search procedure. This was accomplished by making a separate run with starting values of 3,000 ac.ft. and 500 cfs respectively. The derived sizes were 6,584 ac.ft. and 2,835 cfs costing $6,591,000 and resulting in annual system net benefits of $199.000. The results indicated that a local optimum did exist such that additional runs were made with different initial values until it could be reasonably concluded that the proper sizes were 6,584 ac.ft. for the reservoir and 2,835 cfs for the pumping plant.

The hydrologic performance can be characterized by the "degree of protection" provided, i.e., the exceedence frequency of the threshold of damaging flow. At damage center 1030, the zero damage exceedence frequency was reduced from about the 5 times per year event to about the annual event (deduced from page 17 and the additional runs made). Note that damages at station 1030 are quite small in relation to those at 305 and therefore probably had very little influence on the determination of the optimum sizes.

At damage center 305, the frequency of significant damages was reduced from about the 3-year exceedence interval event to about the 10-year event, which incidentally reduced expected annual damages by more than half.

Detailed study of the output can provide insight into the optimization methodology as well as the sensitivity of the system performance to a range of facility sizes. Pages 3 through 6 of Exhibit 3 contain detailed output on the progress of the optimazation. The variables for optimization printed on page 3 are defined below and a review of the search procedure (reference 3) and the corresponding results from the output are described.

Variable Definition

NC = Counter denoting stage in search cycle (1-3)

M = Variable that is being adjusted for this cycle (corresponds to fields on J2 card listed above as SYSTEM OPTIMIZATION)

M1 = Next variable to be adjusted (optimized)

VAR(M) = Current value of variable M

VAR(M1) = Current value of variable M1

OBJ DEV = Used in connection with hydrologic performance constraint; described in example in next section

TANCST = Total annual cost of facilities at current values

ANDMG = Total annual damage for all damage centers for facilities at current values

O FTN(NC) = Objective function that is being minimized; in this example it is the sum of TANCST and ANDMG

Search Procedure (see reference 3)

(1) First, trial sizes of all system components are nominated and the entire system is simulated in all of its hydrologic, costs, and economic detail to calculate the value of the objective function, which for unconstrained optimization is the sum of the equivalent annual cost (TANCST) and annual damage (ANDMG).

The first value (NC=1) of the objective function is 1018.883

(2) Then the size of one component is decreased by a small selected amount (1 percent) and the simulation is repeated for the entire system to compute a new value of the objective function. This is repeated again resulting in three unique values of the objective function for small changes in the size of one component.

The values of the variable and objective function are

NC	VAR(M)	O FTN(NC)
1 $f(X_0)$	10000	1018.883
2 $f(X_0 - \Delta X)$	9900	1018.205
3 $f(X_0 - 2\Delta X)$	9800	1017.645

(3) From these three values, an estimate is made of the component size that would result in the minimum value of the objective function. The computation of the adjustment is shown in Figure 2 and proceeds as follows:

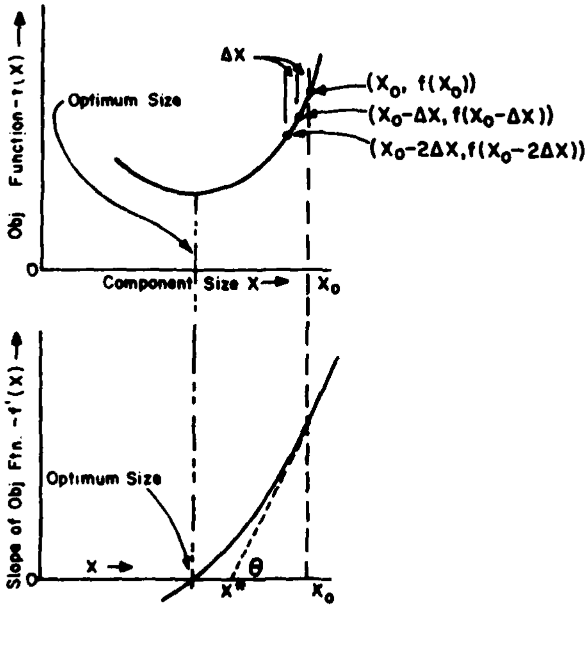


Figure 2.— Adjustment of Component Size by Newton-Raphson Convergence Procedure

$$f''\left(X_o - \frac{\Delta X}{2}\right) = \tan\theta = f'\left(X_o - \frac{\Delta X}{2}\right)\left[\left(X_o - \frac{\Delta X}{2}\right) - X^*\right]^{-1} \quad \ldots\ldots(3)$$

$$\text{or} \quad X^* = X_o - \left[f'\left(X_o - \frac{\Delta X}{2}\right)\right]\left[f''\left(X_o - \frac{\Delta X}{2}\right)\right]^{-1} - \frac{\Delta X}{2} \quad \ldots\ldots\ldots(4)$$

$$\text{in which} \quad f'\left(X_o - \frac{\Delta X}{2}\right) = [f(X_o) - f(X_o - \Delta X)](\Delta X)^{-1} \quad \ldots\ldots\ldots(5)$$

$$f''\left(X_o - \frac{\Delta X}{2}\right) = [f(X_o - 2\Delta X) - 2f(X_o - \Delta X) + f(X_o)](\Delta X)^{-2}. \quad \ldots\ldots(6)$$

and ΔX = incremental change in X; X = size of variable being optimized; X_O = present size of component X; and X^* = projected "new" size for X. The calculation for adjustment of VAR(M) is as follows:

$$f'\left(X_o - \frac{\Delta X}{2}\right) = (1018.883 - 1018.205)/\Delta X = 0.678/\Delta X \quad \ldots\ldots(7)$$

$$f''\left(X_o - \frac{\Delta X}{2}\right) = [1017.645 - 2(1018.205) + 1018.883]/\Delta X^2 \quad .118/\Delta X^2 ..(8)$$

$$X_o = 10000; \; \Delta X = (.01)\,(10000) = 100$$

$$X^* = 10000 - \frac{0.678/100}{.118/(100)^2} - \frac{100}{2} = 9380. \text{ (to closest 10)} \quad \ldots(9)$$

(4) After adjustment of the size of the system component, the entire system is simulated again in detail to compute the new value of the objective function and, provided the objective function has decreased, the procedure then moves to the second system component whose scale is to be optimized.

The output at this stage reads:

VAR 1 ADJ FROM 10000. to 9384.07

and one cycle for one variable has been completed.

(5) The above procedure is repeated for the second and all subsequent components to be optimized.

Note that the same procedure is repeated for variable 9.

(6) A single adjustment has now been made for each component for one complete search of the system component sizes. The procedure is then repeated for two more complete system searches.

(7) The component whose change contributed the most to decreasing the objective function is adjusted next before another complete system search is performed.

(8) The procedure is terminated when either no more improvement in the objective function can be made (within a tolerance) for the component making the greatest contribution to decreasing the objective function, or the complete search cycle is completed.

Note that occasionally no successful adjustment can be made. If the computed adjustment does not reduce the objective function, its value is successively reduced to the original value, testing for improvement at a number of steps (pages 5 and 6 of Exhibit 3).

The remaining output should be self-explanatory. Remember the output is for two plans (existing and the derived system) for nine flood events which results in 18 hydrologic simulations at each control point and two economic evaluations at all damage centers.

SIZING RESERVOIR AND PUMPING PLANT — HYDROLOGIC PERFORMANCE CONSTRAINED

The objective for this example is to determine the size of the facilities that will maximize the system net benefits while simultaneously meeting hydrologic performance targets expressed in terms of desired flow (storage) target and corresponding exceedence frequency. This example extends the previous example for the performance targets of

Reach	Target Value	Exceedence Frequency (Events per Year)
1030	1200 cfs	1.0
305	5000 ac.ft.	.05

The starting values were selected as 5000 ac.ft. and 5000 cfs, respectively.

Pages 1 and 2 of Exhibit 4 contain a listing of the input data with notations on coding revised and added. Pages 3 through 28 contain printout of selected pages of the output.

The derived optimum sizes are 7528 ac.ft. for the reservoir and 6044 cfs for the pumping plant (summary page 28). The total capital cost is $9,889,000 and system annual net benefits are $123,000 (benefit cost ratio

of 1.15). The derived values were adjusted from starting values of 5000 ac.ft. and 5000 cfs, respectively. The sensitivity of the solution to starting values was tested by making a separate run with starting values of 10,000 ac.ft. and 7000 cfs, respectively. The derived sizes were 6,007 ac.ft. and 6,570 cfs costing $9,832,000 and resulting in annual net benefits of $102,000. The hydrologic performance specified is achieved in that the degree of protection provided is 1.0 years (protection against the annual event) for reach 1030 and .05 (protection against the 20-year event) for reach 305 (see pages 15 and 26 of Exhibit 4).

The output detailing the progress of the optimization contains additional information related to the performance target constraints. The additional variables are (page 3, Exhibit 4):

Variable Definition

ISTA = Station where performance target specified

INT FLOW = Flow corresponding to the target exceedence frequency for the current values of the variables

TRG FLOW = Target flow for the target exceedence frequency

FLW OBJ = Component of penalty applied to objective function because of failure to meet target (illustrated later) for this station

FLW DEV = Difference between INT FLW and TRG FLW

OBJ DEV = Penalty applied to objective function because of failure to meet target (multiply)

The additional printout occurs for all stations where performance targets are specified (as many as desired). The optimization proceeds exactly as the previous (unconstrained) example except that the objective function is penalized whenever the performance targets are not met. Note that the first objective function is extremely large (.951E+06) because of the large penalty from not meeting the target for station 305 while the objective function when optimization is complete (page 10, Exhibit 4) essentially has no penalty (.106E+04). The computation of a value of the objective function for the condition blocked out on page 5 (Exhibit 4) will illustrate the role of the penalty assessment. See reference 3 for a description of the objective function.

$$\text{FLW OBJ} = [\ (\text{FLW DEV})/(.10\ \text{TRG FLOW})\ ]^4$$

Station 1030

$$\text{FLW OBJ} = \left(\frac{12.670}{120}\right)^4 = .0001$$

Station 305

$$\text{FLW OBJ} = \left(\frac{782.138}{500}\right)^4 = 5.988$$

Objective Function Assessment

OBJ DEV = .0001 + 5.988 = 5.988

O FTN(NC) = (TANCST + ANDMG) (OBJ DEV + 1)

O FTN(NC) = (774.217 + 265.434) (5.988 + 1) = 7264.80

The printout at the bottom of the pages on which economic output is shown (page 15 for example) summarizes the performance target and final regulated values.

SIZING RESERVOIR, PUMPING PLANT AND DIVERSION

A proposal offered at past public meetings has been to divert a portion of the runoff from subbasin 20 at station 20 into the adjacent watershed (which is presently undeveloped) both to reduce flooding in the downstream reaches and increase wetlands in the adjacent watershed to improve wildlife habitat. This example extends the previous reservoir and pumping plant example (unconstrained) to include a diversion from station 20.

A diversion transfers flow between locations within the system. The performance characteristics are defined by a threshold flow and a diversion capacity. The concept of the diversion relationship is indicated in figure 3. Water diverted may be returned to the system at any downstream location so that it is possible to characterize facilities which would bypass a portion of flood flows around a damage center. Flow may also be permanently diverted from the system, which will be done for this example. The cost is characterized similar to a pumping plant by a capital cost function, a capital recovery factor and annual operation, maintenance and replacement factor.

Table 5 (Appendix A) summarizes the performance and cost data for the proposed diversion.

The coding to include a diversion at station 20 is noted on the listing of input data, pages 1 and 2 of Exhibit 5. Note that it was necessary to include a dummy reservoir at station 20 in order to accommodate the requirements for a diversion.

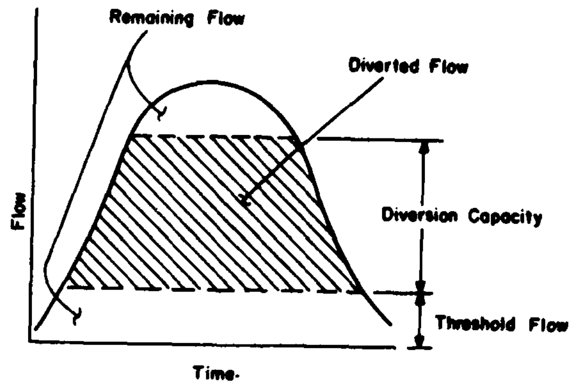


Figure 3.—Effect of Diversion on Flood Hydrograph

Pages 3 through 34 of Exhibit 5 contain selected pages of the output. The derived optimum sizes are 6620 ac.ft. (index storage) for the reservoir, 863 cfs for the diversion and 2250 cfs for the pumping plant (summary page 34). The total capital cost is $7,099,000 and system net benefits are $197,000 (benefit cost ratio of 1.33). The derived values were adjusted from starting values of 4000 ac.ft., 500 cfs and 1000 cfs, respectively, for the reservoir, diversion, and pumping plant. The sensitivity of the solution to starting values was tested by making a separate run with new starting values of 10,000 ac.ft., 3000 cfs and 4000 cfs, respectively. The derived sizes were 6648 ac.ft., 1393 cfs and 2160 cfs, respectively, costing $7,617,000 and resulting in annual net benefits of $167,000. In comparison with the previously derived values, it appears the diversion should be the smaller size. Additional runs demonstrate the value of testing a few starting values in an effort to locate a reasonable optimum.

The hydrologic performance of the derived system can be characterized by the degree of protection provided, i.e., the exceedence frequency of the threshold of damaging flows. At control point 1030, the 0 damage exceedence frequency was reduced from about the five times per year event to about the annual event (about the same as the example without the diversion). At control point 2030, the 0 damage exceedence frequency was not materially changed from the five times per year event. At control point 305, the frequency of significant damage was reduced from about the 3-year exceedence interval event to between the 10 and 15-year events. The residual damages for the system are reduced to about 1/3 of the damages under existing conditions.

SIZING LOCAL PROTECTION PROJECTS

Local protection projects include levees, floodwalls and channel modifications. Ignoring for the moment natural valley storage effects, the hydrologic and economic effects of local projects are truly local,

i.e., do not interact with the system hydrology. If this is the case, and it will be unless the modification is extensive, then a local project can be completely characterized performance-wise by a design Q (or storage) and a flow (or storage) damage function. Damages are usually negligible below the design flow and follow a curve related to the local site hydraulics and damage potential above this point. A levee or floodwall essentially truncates the damage function below the design flow (basic hydraulic-economic relationship unchanged) while channel modifications lower the relationship in response to the improved conveyance characteristics.

The concept embodied in HEC-1 is that a design flow is associated with a unique damage relationship and therefore if the range of feasible design flows are known, the relationship for a specific design flow within the feasible range could be determined. The relationship (flow or storage-damage) for a specific design flow is determined by interpolating between the relationships defining the feasible range. The relationships defining the feasible range are termed "pattern functions;" the minimum design damage function corresponding to the design flow considered the lowest value feasible and the maximum design damage function corresponding to the design flow considered the highest value feasible.

The local projects considered for this example are a channel modification for reach 1030 and a levee for reach 2030. The pattern damage functions for reach 1030 were developed from water surface profile and economic studies. The minimum design damage function corresponds to a "clear and snag" alternative and was constructed by computing water surface profiles for a smoothed boundary to develop a rating curve at the index station that was subsequently combined with an area, elevation, damage relationship. The design flow associated with this function is 1700 cfs, the lower limit of design flow. The maximum design function corresponds to a 40 ft. bottom width, 2 to 1 side slope channel enlargement and was constructed by computing water surface profiles for modified hydraulic geometry to develop a rating curve that was subsequently combined with an area, elevation, damage relationship. The design flow associated with this function is 8300 cfs, the upper limit of design flow for the enlarged channel. Table 6 (Appendix A) summarizes the performance and cost data for the proposed channel modification for reach 1030. Table 6 also contains a generated damage function for a specific design flow to illustrate the interpolation concept.

The upper and lower pattern damage functions for reach 2030 are the same and correspond to existing conditions. The reason for the correspondence is that the effect of a levee is primarily to truncate the function at the design flow. Some change is possible for various designs if the flow area is greatly restricted by the levees. The example assumes no significant conveyance change from the levees, though the methodology does not require the assumption. Table 7 (Appendix A) summarizes the cost and performance data for the proposed levee reach.

The existing conditions damage relationships, cost and runoff hydrology for reaches 1030 and 2030 have been purposefully made the same so that

the methodology developed for handling local projects can be easily observed. The example contains only local projects (other damage centers and alternatives removed) so that the difference in the derived sizes of the two alternatives should only be due to differences in their performance, i.e., modified damage relationships. A listing of the input data for this example is contained on pages 1 and 2 of Exhibit 6.

Pages 3 through 15 of Exhibit 6 contain selected pages of the output of the optimization run.

The derived optimum sizes are about 5000 cfs design flow for both the channel modification reach and the levee reach. This amounts to about a 0.7 exceedence frequency degree of protection. The total capital cost is $207,000 and system annual net benefits of $30,000. The derived values were adjusted from starting values of 2000 cfs design flow for each facility. It is interesting to note that while both facilities began and ended with the same values, the adjustment route to the optimum was different. There was no requirement that they both end up the same size (see pages 3 through 5 of Exhibit 6). In addition, note that while the values derived were the same, the net benefits were different because the damage relationships were quite different. The channel modification cost $104,000 and had average annual benefits of 27,000 for annual net benefits of $19,000 (benefit cost ratio of approximately 3.4). The levee cost $103,000 and had average annual benefits of $19,000 for annual net benefits of $11,000 (benefit cost ratio of approximately 2.4).

SIZING RESERVOIR, PUMPING PLANT, DIVERSION, AND UNIFORM PROTECTION LOCAL PROJECTS

This final example includes all the proposed components that have been previously illustrated. The optimization will be unconstrained and the uniform protection level option for the local projects will be used. The uniform protection level option will in effect cause a "degree of protection" to be optimized for the two local protection projects. A complete listing of the input data is contained on pages 1 through 3 of Exhibit 7 and the complete output on pages 4 through 39.

The derived optimum sizes are 6701 ac.ft. for the reservoir, 0.2 exceedence frequency for the levee and channel projects (2947 cfs for the channel modification and 7660 cfs for the levee), 670 cfs for the diversion and 2450 cfs for the pumping plant for a total capital cost of $7,408,000 and system net benefits of $196,000 (benefit cost ratio of 1.31). The optimum sizes were adjusted from starting values of 4000 ac.ft. for the reservoir, 0.2 exceedence frequency (uniform protection) for local projects, 500 cfs for the diversion and 1000 cfs for the pumping plant. A comparison of Exhibits 5 and 7 indicates that the inclusion of local projects has very little effect on the optimum sizes of the major facilities (reservoir and pumping plant). The diversion capacity was lowered slightly from that derived in Exhibit 5 which probably means that it is more efficient to protect reach 2030 by the levee project.

OBJECTIVE OF THE FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION UTILIZING HEC-1

The optimization algorithm (or search procedure) discussed in this training document has been developed to assist the planner in systematically and efficiently screening a large number of possible flood control alternatives. Although there is an upper limit to the number which can be satisfactorily and economically optimized in one particular computer run, it is still possible to analyze a large number of components by grouping. In the Phoenix Urban Study, Los Angeles District Corps of Engineers (reference 6), there were eight upstream storage alternatives to be evaluated. Although each component was analyzed individually, it was possible to determine which component and combination of components were economically feasible by making several runs in groups of two and three components and comparing the economic and hydrologic consequences.

It should be emphasized that the optimization procedure of HEC-1 is a planning tool for determining potential and economically feasible flood control alternatives. Once those that have potential are selected, then a more detailed simulation of the operational and hydraulic characteristics of a particular component will probably be required as various stages of study (leading to design) are undertaken.

REFERENCES

1. HEC-1, Flood Hydrograph Package, Users Manual, U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Davis, California, January 1973.

2. Input Data Description, Addendum 6 to HEC-1 Users Manual, September 1974.

3. Davis, Darryl W., "Optimal Sizing of Urban Flood Control Systems," Technical Paper No. 42, U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Davis, California, March 1974.

4. Optimization Model for the Design of Urban Flood-Control Systems, Technical Report CRWR-141, Center for Research in Water Resources, College of Engineering, University of Texas, Austin, Texas, November 1976.

5. Expected Annual Flood Damage Computation, Users Manual, U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Davis, California, June 1977.

6. *Interagency Task Force on Orme Dam Alternatives*, Preliminary Flood Control Summary Report, Phoenix Urban Study, Los Angeles District, U.S. Army Corps of Engineers, Los Angeles, California, September 1977.

APPENDIX A

INPUT DATA

TABLE 1

HYDROLOGIC DATA
(Existing Conditions)

DRAINAGE AREA

Subbasin		Area (square miles)
10		35.1
20		35.1
30		10.0
	TOTAL	80.2

SUBBASIN RUNOFF
SYNTHETIC STORM EVENT
(hourly values)

Inflow to Sta. 10 (cfs)		Inflow to Sta. 20 (cfs)		Inflow to Sta. 30 (cfs)	
24	2200	24	2200	8	730
24	1840	24	1840	8	615
26	1540	26	1540	9	515
33	1250	33	1250	11	415
50	995	50	995	17	330
85	775	85	775	28	255
190	605	190	605	63	200
375	470	375	470	125	155
515	365	515	365	170	120
590	280	590	280	195	93
660	215	660	215	220	72
710	160	710	160	230	54
760	120	760	120	255	41
800	95	800	95	265	32
840	77	840	77	280	26
910	66	910	66	305	22
1040	59	1040	59	350	20
1290	53	1290	53	430	18
1920	49	1920	49	640	16
3000	42	3000	42	1000	14
3950	40	3950	40	1320	13
4600	38	4600	38	1540	12
5080	35	5080	35	1650	11
5360	33	5360	33	1800	11
5370	30	5370	30	1810	11
5100	30	5100	30	1690	10
4600	29	4600	29	1530	10
3980	27	3980	27	1330	9
3330	25	3330	25	1110	9
2720	25	2720	25	900	9

TABLE 1 (Continued)

HYDROLOGIC DATA
(Existing Conditions)

Reach 10-30 Mod. Puls Routing Criteria[1]

Storage (ac.ft.)	0	50	475	940	2135	3080	6300
Outflow (cfs)	0	200	1020	2050	6100	10250	24000

Reach 20-30 Mod Puls Routing Criteria[1]

Storage (ac.ft.)	0	50	475	940	2135	3080	6300
Outflow (cfs)	0	200	1020	2050	6100	10250	24000

Outflow Culvert (Sta. 30) Mod. Puls Routing Criteria[1]

Storage (ac.ft.)	0	400	100000[2]
Outflow (cfs)	0	1200	1200

1/ Storage-outflow data should extend beyond the maximum values computed in the multiflood-multiplan options.

2/ Note that the outflow becomes constant and equal to 1200 cubic feet per second when the detention storage equals or exceeds 400 acre feet.

TABLE 2
ECONOMIC DAMAGE-FREQUENCY DATA
(Existing Conditions)

Damage Center 1030

Exceedence Frequency (Events per Yr)	Flow (cfs)	Type 1 Damage ($1000)	Type 2 Damage ($1000)	Type 3 Damage ($1000)
6.000	1030	0.00	0.00	0.00
5.500	1130	0.00	0.00	0.00
4.500	1380	0.10	0.50	1.00
3.500	1740	0.20	0.70	1.50
2.500	2280	0.30	1.50	3.20
1.500	3200	0.30	2.20	4.70
.900	4220	0.40	2.90	6.50
.700	4800	0.50	3.50	7.80
.500	5620	0.60	4.00	9.30
.350	6480	0.70	4.70	11.00
.250	7340	0.80	5.80	13.70
.150	8540	0.90	6.60	15.60
.100	10000	1.00	8.00	19.00
.050	12100	1.20	10.30	23.00
.020	15100	1.50	15.00	27.80
.005	21000	1.80	18.10	30.20

Damage Center 2030

Exceedence Frequency (Events per Yr)	Flow (cfs)	Type 1 Damage ($1000)
6.000	1030	0.00
5.500	1130	0.00
4.500	1380	1.60
3.500	1740	2.40
2.500	2280	5.00
1.500	3200	7.20
.900	4220	9.80
.700	4800	11.80
.500	5620	13.90
.350	6480	16.40
.250	7340	20.30
.150	8540	23.10
.100	10000	28.00
.050	12100	34.50
.020	15100	44.30
.005	21000	50.10

TABLE 2 (Continued)
ECONOMIC DAMAGE-FREQUENCY DATA
(Existing Conditions)

Damage Center 305[1]

Exceedence Frequency (Events per yr)	Storage (ac-ft)	Type 1 Damage ($1000)	Type 2 Damage ($1000)
.700	1500	0.00	0.00
.600	2300	37.50	10.50
.450	4000	75.00	15.00
.250	7000	1125.00	52.50
.100	12500	3150.00	105.00
.050	20000	5850.00	202.50
.020	28000	7050.00	300.00
.010	37000	9000.00	390.00
.005	50000	10650.00	540.00
.002	76000	11250.00	585.00

Flood Ratios for Multiflood, Multiplan Evaluation

0.25	0.30	0.50	0.70	1.00	1.50	2.20	3.25	4.40

1/ Note that the damage-frequency relationship (for damage center 305) is a function of storage and not discharge.

TABLE 3
RESERVOIR PERFORMANCE AND COST DATA

Low Level Outlet

Area of Opening	$= 35\ ft^2$
Orfice Coefficient, C, in the general expression $Q = C\ A\ (2gH)^{Exp.}$ (free discharge)	= 0.71
Cenderline Elevation of Orfice	= 975 ft
No Tailwater (no submergence) Exponent of head (Exp.)	= 0.5

Overflow Spillway

Type	= Ogee
Length	= 35 ft
Weir Coefficient, C, in the general expression $Q = C\ L\ H^{3/2}$	= 2.86

Cost and Site Characteristics[1]

Capacity (ac.ft.)	0	2500	4000	5200	6800	9000	11500	15500	21000	30000
Elevation (ft)	965	1000	1015	1030	1045	1060	1075	1090	1105	1120
Cost ($1000)	0	1500	2400	3000	3600	4350	4950	5550	6000	7200

Annual Cost Data

Annual Operation and Maintenance = 2.3% of Capital Cost
Discount Factor (Capital Recovery)= 5.04%

Constraints

Reservoir size must be in range of 0 to 25,000 ac.ft.

1/ Capacity-elevation data should extend beyond the maximum values computed in the multiflood-multiplan options and the maximum reservoir size designated.

TABLE 4
PUMPING PLANT PERFORMANCE AND COST DATA

Cost and Performance Data

Capacity (cfs)	0	250	500	1000	2000	6000	8000	10000
Cost ($1000)	0	670	1000	1600	2300	6000	7860	8670

Annual Cost Data

Annual Operation and Maintenance = 2.3% of Capital Cost
Discount Factor (Capital Recovery) = 5.04%
Annual Power Cost = $100,000[1]

Sizing and Operation Data

Pumping plant must be between 0 and 10,000 cfs.
Pumps activate at storage level (at station 30) = 1500 ac.ft.

1/ Annual power cost is adjusted based on the difference in computed volumes at the pumping facility as system component sizes vary from specified initial values to optimized values

TABLE 5
DIVERSION PERFORMANCE AND COST DATA

Performance and Cost Data

Capacity (cfs)	0	1250	2500	3750	5000	7500	10000	15000	20000
Cost ($1000)	0	1500	2600	3400	4200	5200	6100	7500	8300

Annual Cost Data

Annual Operation and Maintenance = 1.5% of Capital Cost
Discount Factor (Capital Recovery) = 5.04%

Operation and Constraints

Diversion activation threshold = 1,500 cfs
Size limit between 0 and 20,000 cfs

TABLE 6

CHANNEL MODIFICATION COST AND PERFORMANCE DATA

Damage Center 1030

Flow (cfs)	Minimum Design Damage Function Design Q = 1700cfs			Maximum Design Damage Function Design Q = 8300cfs		
	Type 1 Damage ($1000)	Type 2 Damage ($1000)	Type 3 Damage ($1000)	Type 1 Damage ($1000)	Type 2 Damage ($1000)	Type 3 Damage ($1000)
1030	0.00	0.00	0.00	0.00	0.00	0.00
1130	0.00	0.00	0.00	0.00	0.00	0.00
1380	0.00	0.00	0.00	0.00	0.00	0.00
1740	0.01	0.08	0.13	0.00	0.00	0.00
2280	0.14	0.95	1.73	0.00	0.00	0.00
3200	0.25	1.73	3.44	0.00	0.00	0.00
4220	0.36	2.53	5.85	0.00	0.00	0.00
4800	0.43	2.73	7.23	0.00	0.00	0.00
5620	0.53	3.53	8.91	0.00	0.00	0.00
6480	0.62	4.08	10.63	0.00	0.00	0.00
7340	0.69	5.01	13.11	0.00	0.00	0.00
8540	0.82	6.16	15.03	0.04	0.25	0.44
10000	0.97	7.70	18.61	0.25	1.75	3.50
12100	1.17	9.90	22.09	0.42	3.18	7.15
15100	1.43	14.08	27.00	0.64	5.04	12.29
21000	1.76	17.51	29.32	0.99	7.98	16.86

Flow (cfs)	Interpolated Damage Function Design Q = 4830cfs		
	Type 1 Damage ($1000)	Type 2 Damage ($1000)	Type 3 Damage ($1000)
1030	0.00	0.00	0.00
1130	0.00	0.00	0.00
1380	0.00	0.00	0.00
1740	0.00	0.00	0.00
2280	0.00	0.00	0.00
3200	0.00	0.00	0.00
4825[1]	0.00	0.00	0.00
4830[1]	0.11	0.38	1.07
5620	0.20	1.15	2.69
6480	0.29	1.70	4.41
7340	0.36	2.63	6.89
8540	0.45	3.36	8.11
10000	0.63	4.88	11.44
12100	0.81	6.71	15.01
15100	1.06	9.79	20.02
21000	1.40	12.99	23.41

1/ In the interpolation scheme zero damages are estimated to occur at a peak flow which is 99.9 percent of the design flow.

TABLE 6 (Continued)

CHANNEL MODIFICATION COST AND PERFORMANCE DATA

Performance and Cost Data

Capacity (cfs)	1700	5000	5500	7000	8300	9300
Cost ($1000)	42	103	149	222	283	340

Annual Cost Data

Annual Operation and Maintenance = 2.3% of Capital Cost
Discount Factor (Capital Recovery) = 5.04 %

Design Limits

Minimum Design Q = 1700 cfs
Maximum Design Q = 8300 cfs

TABLE 7

LEVEE COST AND PERFORMANCE DATA

Damage Center 2030

Flow (cfs)	Minimum Design Damage Function Damage ($1000)	Maximum Design Damage Function Damage ($1000)
1030	0.00	0.00
1130	0.00	0.00
1380	1.60	1.60
1740	2.40	2.40
2280	5.00	5.00
3200	7.20	7.20
4220	9.80	9.80
4800	11.80	11.80
5620	13.90	13.90
6480	16.40	16.40
7340	20.30	20.30
8540	23.10	23.10
10000	28.00	28.00
12100	34.50	34.50
15100	44.30	44.30
21000	50.10	50.10

Performance and Cost Data

Capacity (cfs)	1700	5000	5500	7000	8300	9300
Cost ($1000)	42	103	149	222	283	340

Annual Cost Data

Annual Operation and Maintenance = 2.3% of Capital Cost
Discount Factor (Captial Recovery) = 5.04%

Design Limits

Minimum design Q = 1700 cfs   Maximum design Q = 8300 cfs

EXHIBIT 1

HYDROLOGIC MODEL

(Existing Conditions)

```
A      FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
A      HYDROLOGIC MODEL
A      EXISTING CONDITIONS
B     60       1                                                      4
I      3
K      0      10                                              1
J      POTENTIAL RESERVOIR INFLOW
N     -1            35.1                                              0
N     24      24      26      33      50      85     190     375     515     590
N    660     710     760     800     840     910    1040    1290    1920    3000
N   3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
N   2200    1840    1540    1250     995     775     605     470     365     280
N    215     160     120      95      77      66      59      53      49      42
N     40      38      35      33      30      30      29      27      25      25
K      1    1030                                              1
J      POTENTIAL CHANNEL MODIFICATION REACH
Y                             1
1      1                                                     -1
2      0      50     475     940    2135    3080    6300
3      0     200    1020    2050    6100   10250   24000
K      0      20
N     -1            35.1                                              0
N     24      24      26      33      50      85     190     375     515     590
N    660     710     760     800     840     910    1040    1290    1920    3000
N   3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
N   2200    1840    1540    1250     995     775     605     470     365     280
N    215     160     120      95      77      66      59      53      49      42
N     40      38      35      33      30      30      29      27      25      25
K      1    2030                                              1
J      POTENTIAL LEVEE AND/OR BYPASS REACH
Y                             1
1      1                                                     -1
2      0      50     475     940    2135    3080    6300
3      0     200    1020    2050    6100   10250   24000
K      0      30                                              1
J      LOCAL INFLOW TO FOREBAY POOL
N     -1            10.0                                              0
N      8       8       9      11      17      28      63     125     170     195
N    220     230     255     265     280     305     350     430     640    1000
N   1320    1540    1650    1800    1810    1690    1530    1330    1110     900
N    730     615     515     415     330     255     200     155     120      93
N     72      54      41      32      26      22      20      18      16      14
N     13      12      11      11      11      10      10       9       9       9
K      3      30                                              1
J      COMBINED INFLOW TO FOREBAY POOL
K      1     305                                              1
J      GRAVITY OUTLET THROUGH LEVEE
Y                             1
1      1                                                     -1
2      0     800  100000
3      0    1200    1200
K     99
A
A
A
A
A
```

Exhibit 1
1 of 2

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	10	5370.	5018.	2635.	1158.	35.10
		(152.06)(	142.10)(	74.63)(	32.80)(	90.91)
ROUTED TO	1030	4312.	4092.	2471.	1158.	35.10
		(122.10)(	115.87)(	69.98)(	32.78)(	90.91)
HYDROGRAPH AT	20	5370.	5018.	2635.	1158.	35.10
		(152.06)(	142.10)(	74.63)(	32.80)(	90.91)
ROUTED TO	2030	4312.	4092.	2471.	1158.	35.10
		(122.10)(	115.87)(	69.98)(	32.78)(	90.91)
HYDROGRAPH AT	30	1810.	1670.	878.	386.	10.00
		(51.25)(	47.29)(	24.85)(	10.92)(	25.90)
3-COMBINED	30	10154.	9579.	5772.	2701.	80.20
		(287.53)(	271.25)(	163.46)(	76.47)(	207.72)
ROUTED TO	305	1200.	1200.	1200.	966.	80.20
		(33.98)(	33.98)(	33.98)(	27.36)(	207.72)

EXHIBIT 2

MULTIFLOOD, MULTIPLAN MODEL

(Economic Evaluation of Existing Conditions)

```
A          FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
R-A        MULTIFLOOD, MULTIPLAN MODEL
R-A        ECONOMIC EVALUATION OF EXISTING CONDITIONS
B       60       1                                                        4
R-1     5
N-J     2        9       1
N-1  0.25     0.30    0.50    0.70    1.00    1.50    2.20    3.25    4.40
K        0      10                                       1
1          POTENTIAL RESERVOIR INFLOW
R-M     -1            35.1                                        1
N       24      24      26      33      50      85     190     375     515     590
N      660     710     760     800     840     910    1040    1290    1920    3000
N     3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
N     2200    1840    1540    1250     995     775     605     470     365     280
N      215     160     120      95      77      66      59      53      49      42
N       80      38      35      33      30      30      29      27      25      25
R-K      1    1030       1                                   1
1          POTENTIAL CHANNEL MODIFICATION REACH
R-Y                              1       1                        0
1        1                                              -1
2        0      50     475     940    2135    3080    6300
3        0     200    1020    2050    6100   10250   24000
N-Z   1030      16       3       1
1        6     5.5     4.5     3.5     2.5     1.5      .9      .7      .5     .35
1      .25     .15     .10     .05     .02    .005
2     1030    1130    1380    1740    2280    3200    4220    4800    5620    6480
2     7340    8540   10000   12100   15100   21000
3
4        0       0      .1      .2      .3      .3      .4      .5      .6      .7
4       .8      .9     1.0     1.2     1.5     1.8
4        0       0      .5      .7     1.5     2.2     2.9     3.5     4.0     4.7
4      5.8     6.6     8.0    10.3    15.0    18.1
4        0       0     1.0     1.5     3.2     4.7     6.5     7.8     9.3    11.0
N-4   13.7    15.6    19.0    23.0    27.8    30.2
K        0      20
R-M     -1            35.1                                        1
N       24      24      26      33      50      85     190     375     515     590
N      660     710     760     800     840     910    1040    1290    1920    3000
N     3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
N     2200    1840    1540    1250     995     775     605     470     365     280
N      215     160     120      95      77      66      59      53      49      42
N       80      38      35      33      30      30      29      27      25      25
R-K      1    2030       1                                   1
1          POTENTIAL LEVEE AND/OR BYPASS REACH
R-Y                              1       1                        9
1        1                                              -1
2        0      50     475     940    2135    3080    6300
3        0     200    1020    2050    6100   10250   24000
N-Z   2030      16       1       1
1        6     5.5     4.5     3.5     2.5     1.5      .9      .7      .5     .35
1      .25     .15     .10     .05     .02    .005
2     1030    1130    1380    1740    2280    3200    4220    4800    5620    6480
2     7340    8540   10000   12100   15100   21000
N-3
```

LEGEND

N = NEW INPUT DATA
R = REVISED INPUT DATA
( ) = REVISED INPUT DATA

Exhibit 2
1 of 6

```
N- 4       0      0     1.6     2.4     5.0     7.2     9.8    11.8    13.9    16.4
N- 4    20.3   23.1    28.0    34.5    44.3    50.1
   K       0     30                                       1
   1        LOCAL INFLOW TO FOREBAY POOL
                                                                         (1)
R- M      -1           10.0
   N       8      8       9      11      17      28      63     125     170     195
   N     220    230     255     265     280     305     350     430     680    1000
   N    1320   1540    1650    1800    1810    1690    1530    1330    1110     900
   N     730    615     515     415     330     255     200     155     120      93
   N      72     54      41      32      26      22      20      18      16      14
   N      13     12      11      11      11      10      10       9       9       9
   K       3     30                                       1
   1        COMBINED INFLOW TO FOREBAY POOL
R- K       1    305     (1)                               1
   1        GRAVITY OUTLET THROUGH LEVEE
R- Y                              1     (1)                              (1)
   1       1                                             -1
   2       0    400  100000
   3       0   1200    1200
N- Z     305     10       2       1
   1     .70    .60     .45     .25     .10     .05     .02     .01    .005    .002
   2    1500   2300    4000    7000   12500   20000   28000   37000   50000   76000
   3
   4       0   37.5     75.    1125    3150    5850    7050    9000   10650   11250
N- 4       0   10.5      15    52.5     105   202.5     300     390     560     585
   K      99
   A
   A
   A
   A
   A
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

Exhibit 2
2 of 6

ECON DATA FOR STATION 1030 IDENTIFIED AS STATION 1030

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IABST	ADSCNT	AANCST	ILPR
1030	16	3	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1130.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4800.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	6480.	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8540.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15100.	44.300	1.500	15.000	27.800
.005	21000.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.98	.07	.30	.61
3	1940.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.49
8	15177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97

FLOOD DAMAGES FOR STATION 1030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.98	.07	.30	.61
3	1940.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.49
8	15177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97
		AVG ANN BFT		0.00	.00	-.00	.00

ECON DATA FOR STATION 2030 IDENTIFIED AS STATION 2030

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NOMB	IBAME	TRGT	DGPRT	IABBT	ADBCNT	AANCST	ILPR
2030	16	1	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.600	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6480.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	981.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1980.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	981.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1980.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58
		AVG ANN BFT		.00	0.00

Exhibit 2
4 of 6

ECON DATA FOR STATION 305 IDENTIFIED AS STATION 305

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IABST	ADSCNT	AANCST	ILPR
305	10	2	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 305 PLAN 1

FREQ	STOR	SUM	TYPE 1	TYPE 2
.700	1500.	0.000	0.000	0.000
.600	2300.	48.000	37.500	10.500
.450	4000.	90.000	75.000	15.000
.250	7000.	1177.500	1125.000	52.500
.100	12500.	3255.000	3150.000	105.000
.050	20000.	6052.500	5850.000	202.500
.020	28000.	7350.000	7050.000	300.000
.010	37000.	9390.000	9000.000	390.000
.005	50000.	11190.000	10650.000	540.000
.002	76000.	11835.000	11250.000	585.000

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 305 PLAN 1

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1486.	.700	.152	2.02	1.58	.44
3	3587.	.480	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15876.	.075	.075	311.36	300.95	10.41
7	28937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40

FLOOD DAMAGES FOR STATION 305 PLAN 2

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1486.	.700	.152	2.02	1.58	.44
3	3587.	.480	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15876.	.075	.075	311.36	300.95	10.41
7	28937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40
		AVG ANN BFT		.00	-.00	.00

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 1.00	RATIO 6 1.50	RATIO 7 2.20	RATIO 8 3.25	RATIO 9 4.40
HYDROGRAPH AT	10	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	7 .03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	1030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
			(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
HYDROGRAPH AT	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	2030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
			(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
HYDROGRAPH AT	30	10.00	1	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
	(	25.90)	(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
			2	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
			(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
3 COMBINED	30	80.20	1	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
	(	207.72)	(	62.84)(	75.79)(	129.21)(	194.23)(	287.53)(	444.39)(	672.47)(	1000.86)(	1359.53)
			2	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
			(	62.84)(	75.79)(	129.21)(	194.23)(	287.53)(	444.39)(	672.47)(	1000.86)(	1359.53)
ROUTED TO	305	80.20	1	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
	(	207.72)	(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			2	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
			(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			PEAK STORAGES IN ACRE FEET (1000 CUBIC METERS)									
			1	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
			(	1278.)(	1833.)(	4424.)(	7283.)(	11788.)(	19583.)(	30760.)(	47734.)(	66455.)
			2	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
			(	1278.)(	1833.)(	4424.)(	7283.)(	11788.)(	19583.)(	30760.)(	47734.)(	66455.)

EXHIBIT 3

SIZING RESERVOIR AND PUMPING PLANT

(Unconstrained)

```
   A        FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
 R-A        SIZING RESERVOIR AND PUMPING PLANT
 R-A        UNCONSTRAINED
 R-A      60       1                                                 (3)
 R-1     (6)
   J       2       9       1
   1    0.25    0.50    0.50    0.70    1.00    1.50    2.20    3.25    4.40
 N-2  -10000                                                       -4000
 N-4
   K       0      10                                       1
   1        POTENTIAL RESERVOIR INFLOW
   N      -1            35.1                                               1
   N      24      24      26      33      50      85     190     375     515     590
   N     660     710     760     800     840     910    1040    1290    1920    3000
   N    3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
   N    2200    1640    1540    1250     995     775     605     470     365     280
   N     215     160     120      95      77      66      59      53      49      42
   N      40      38      35      33      30      30      29      27      25      25
 N-K       1     110                               2       1
   1        PROPOSED RESERVOIR
   Y                              -1       0
   Y                               1       0       1
   I       1                                              -1
   S   25000       0     200   975.0      .5   100.0    .023   .0504
   1       0    2500    4000    5200    6800    9000   11500   15500   21000   30000
   2     965    1000    1015    1030    1045    1060    1075    1090    1105    1120
 N-3       0    1500    2400    3000    3600    4350    4950    5550    6000    7200
   K       1    1030       1                               1
   1        POTENTIAL CHANNEL MODIFICATION REACH
   V                               1       1                               0
   I       1                                              -1
   2       0      50     475     940    2135    3080    6300
   3       0     200    1020    2050    6100   10250   24000
   Z    1030      16       3       1
   1       6     5.5     4.5     3.5     2.5     1.5      .9      .7      .5     .35
   1     .25     .15     .10     .05     .02    .005
   2    1030    1130    1380    1740    2280    3200    4220    4800    5620    6480
   2    7340    8540   10000   12100   15100   21000
   3
   4       0       0      .1      .2      .3      .3      .4      .5      .6      .7
   4      .8      .9     1.0     1.2     1.5     1.8
   4       0       0      .5      .7     1.5     2.2     2.9     3.5     4.0     4.7
   4     5.8     6.6     8.0    10.3    15.0    18.1
   4       0       0     1.0     1.5     3.2     4.7     6.5     7.8     9.3    11.0
   4    13.7    15.6    19.0    23.0    27.8    30.2
   K       0      20
   N      -1            35.1                                               1
   N      24      24      26      33      50      85     190     375     515     590
   N     660     710     760     800     840     910    1040    1290    1920    3000
   N    3950    4600    5080    5360    5370    5100    4600    3980    3330    2720
   N    2200    1840    1540    1250     995     775     605     470     365     280
   N     215     160     120      95      77      66      59      53      49      42
   N      40      38      35      33      30      30      29      27      25      25
   K       1    2030       1                               1
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

```
   1      POTENTIAL LEVEE AND/OR BYPASS REACH
   Y                                    1        1                                   0
   1        1                                                      -1
   2        0       50      475      940     2135     3080     6300
   3        0      200     1020     2050     6100    10250    24000
   Z     2030       16        1        1
   1        6      5.5      4.5      3.5      2.5      1.5       .9       .7       .5      .35
   1      .25      .15      .10      .05      .02     .005
   2     1030     1130     1380     1740     2280     3200     4220     4800     5620     6480
   2     7340     8540    10000    12100    15100    21000
   3
   4        0        0      1.6      2.4      5.0      7.2      9.8     11.8     13.9     16.4
   4     20.3     23.1     26.0     34.5     44.3     50.1
   K        0       30                                                  1
   1      LOCAL INFLOW TO FOREBAY POOL
   N       -1              10.0                                                          1
   N        8        8        9       11       17       28       43      125      170      195
   N      220      230      255      265      280      305      350      430      680     1000
   N     1320     1540     1650     1800     1810     1690     1530     1330     1110      900
   N      736      615      515      415      330      255      200      155      120       93
   N       72       54       41       32       26       22       20       18       16       14
   N       13       12       11       11       11       10       10        9        9        9
   K        3       30                                                  1
   1      COMBINED INFLOW TO FOREBAY POOL
N- K        1      305        1                          2        1
   1      PROPOSED PUMPING PLANT SITE
   Y                                    1        0                                   1
   1        1                                                      -1
   2        0      400   100000
   3        0     1200     1200
   Y                                    1                           9                 1
   1        1                                                      -1
   2        0      400   100000
   3        0     1200     1200
   4    10000        0     1500      100     .023    .0504
   1        0      250      500     1000     2000     6000     8000    10000
N- 2        0      670     1000     1600     2300     6000     7860     8670
   Z      305       10        2        1
   1      .70      .60      .45      .25      .10      .05      .02      .01     .005     .002
   2     1500     2300     4000     7000    12500    20000    28000    37000    50000    76000
   3
   4        0     37.5      75.     1125     3150     5850     7050     9000    10650    11250
   4        0     10.5       15     52.5      105    202.5      300      390      580      585
   K       99
   A
   A
   A
   A
   A
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

```
FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
SIZING RESERVOIR AND PUMPING PLANT
UNCONSTRAINED

                           JOB SPECIFICATION
     NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
     60      1      0      0      0      0      0      0      3      0
                       JUPER    NWT  LROPT  TRACE
                           6      0      0      0

                   MULTI-PLAN ANALYSES TO BE PERFORMED
                       NPLAN= 2 NRTIO= 9 LRTIO= 1
 RTIOS=    .25    .30    .50    .70   1.00   1.50   2.20   3.25   4.40

    VAR 1      VAR 2      VAR 3      VAR 4      SYSTEM OPTIMIZATION
                                                 VAR 5      VAR 6      DIV 7      DIV 8      PMP 9      PMP 10
  -10000.         0.         0.         0.         0.         0.         0.         0.     -4000.         0.

                        FIXED COST INPUT
                   FCAP      FDCNT        FAN
                     0.     0.0000     0.0000
                     0.         0.         0.

                            NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                             1  1  1   .100E+05   .100E+05      0.000    741.516    277.367  .102E+04

                            NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                             2  1  1   .990E+04   .990E+04      0.000    739.917    278.288  .102E+04

                            NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                             3  1  1   .980E+04   .980E+04      0.000    738.325    279.320  .102E+04
OBJECTIVE FUNCTION FOR VARIABLE 1     .1019E+04     .1018E+04     .1018E+04
```

```
                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       1  9  1   .400E+04  .938E+04    0.000    731.737    284.417  .102E+04
VAR  1 ADJ FROM       10000.00 TO        9384.07
                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       2  9  1   .396E+04  .938E+04    0.000    729.021    286.506  .102E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       3  9  1   .392E+04  .938E+04    0.000    726.305    288.618  .101E+04

OBJECTIVE FUNCTION FOR VARIABLE 9       .1016E+04       .1016E+04       .1015E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       1  1  9   .938E+04  .295E+04    0.000    660.364    344.595  .100E+04
VAR  9 ADJ FROM        4000.00 TO        2948.78

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       2  1  9   .929E+04  .295E+04    0.000    658.880    346.024  .100E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       3  1  9   .920E+04  .295E+04    0.000    657.398    347.476  .100E+04

OBJECTIVE FUNCTION FOR VARIABLE 1       .1005E+04       .1005E+04       .1005E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       1  9  1   .295E+04  .912E+04    0.000    656.170    348.714  .100E+04
VAR  1 ADJ FROM        9384.07 TO        9118.64

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       2  9  1   .292E+04  .912E+04    0.000    654.168    350.656  .100E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       3  9  1   .289E+04  .912E+04    0.000    652.166    352.606  .100E+04

OBJECTIVE FUNCTION FOR VARIABLE 9       .1005E+04       .1005E+04       .1005E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       1  1  9   .912E+04  .274E+04    0.000    641.808    363.145  .100E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       1  1  9   .912E+04  .289E+04    0.000    651.861    352.917  .100E+04
VAR  9 ADJ FROM        2948.78 TO        2885.32

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       2  1  9   .903E+04  .289E+04    0.000    650.922    354.382  .100E+04

                                                                      NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                                       3  1  9   .894E+04  .289E+04    0.000    648.514    355.885  .100E+04

OBJECTIVE FUNCTION FOR VARIABLE 1       .1005E+04       .1005E+04       .1004E+04
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                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .137E+05    0.000    711.373   319.365  .103E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .105E+05    0.000    673.724   337.923  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .953E+04    0.000    658.346   346.654  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .912E+04    0.000    651.861   352.917  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           2  9  1  .286E+04  .912E+04    0.000    649.902   354.917  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           3  9  1  .283E+04  .912E+04    0.000    647.943   356.916  .100E+04
OBJECTIVE FUNCTION FOR VARIABLE 9     .1005E+04     .1005E+04     .1005E+04
                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  1  9  .912E+04  .433E+04    0.000    749.811   272.677  .102E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  1  9  .912E+04  .332E+04    0.000    681.246   325.665  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  1  9  .912E+04  .302E+04    0.000    660.677   344.347  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  1  9  .912E+04  .289E+04    0.000    651.861   352.917  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           2  1  9  .903E+04  .289E+04    0.000    650.422   354.382  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           3  1  9  .894E+04  .289E+04    0.000    648.514   355.885  .100E+04
OBJECTIVE FUNCTION FOR VARIABLE 1     .1005E+04     .1005E+04     .1004E+04
                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .137E+05    0.000    711.373   319.365  .103E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .105E+05    0.000    673.724   337.923  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .953E+04    0.000    658.346   346.654  .101E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           1  9  1  .289E+04  .912E+04    0.000    651.861   352.917  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           2  9  1  .286E+04  .912E+04    0.000    649.902   354.917  .100E+04

                                          NC  M M1   VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                           3  9  1  .283E+04  .912E+04    0.000    647.943   356.916  .100E+04
OBJECTIVE FUNCTION FOR VARIABLE 9     .1005E+04     .1005E+04     .1005E+04
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NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  1  9   .912E+04   .833E+04     0.000     749.811    272.677  .102E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  1  9   .912E+04   .332E+04     0.000     681.246    325.665  .101E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  1  9   .912E+04   .302E+04     0.000     660.677    344.347  .101E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  1  1   .912E+04   .912E+04     0.000     651.861    352.917  .100E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 2  1  1   .903E+04   .903E+04     0.000     650.422    354.382  .100E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 3  1  1   .894E+04   .894E+04     0.000     648.514    355.885  .100E+04
OBJECTIVE FUNCTION FOR VARIABLE 1      .1005E+04      .1005E+04      .1004E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  9  1   .289E+04   .137E+05     0.000     711.373    319.365  .103E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  9  1   .289E+04   .105E+05     0.000     673.724    337.923  .101E+04

NC  M M1    VAR(M)     VAR(M1)    OBJ DEV     TANCST       ANDMG O FTN(NC)
 1  9  1   .289E+04   .953E+04     0.000     658.346    346.654  .101E+04


**********     **********     **********     **********     **********

                        SUB-AREA RUNOFF COMPUTATION

           POTENTIAL RESERVOIR INFLOW
                 ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME  ISTAGE  IAUTO
                  10       0       0       2       0      0      1      0       0

                    PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                  PLAN 1,RATIO 1
    6.      6.      7.      8.     13.     21.     48.     94.    129.    188.
  165.    178.    190.    200.    210.    228.    260.    323.    480.    750.
  987.   1150.   1270.   1340.   1343.   1275.   1150.    995.    833.    680.
  550.    460.    385.    313.    249.    194.    151.    118.     91.     70.
   54.     40.     30.     24.     19.     17.     15.     13.     12.     11.
   10.     10.      9.      8.      8.      8.      7.      7.      6.      6.

**********     **********     **********     **********     **********
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                                        HYDROGRAPH ROUTING

                 PROPOSED RESERVOIR
                         ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                           110       1       0       0       0       2       1       0       0

                                         PLAN 1
                                      ROUTING DATA
                 QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
                   0.0   0.000    0.00      -1       0       0       0       0       0

                                         PLAN 2
                                      ROUTING DATA
                 QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
                   0.0   0.000    0.00       1       0       1       0       0       0

                         NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                             1       0       0   0.000   0.000   0.000     -1.

                                      RESERVOIR DATA
      CAPMX   CAPMN    COQL   ELEVL    EXPL    COQW  RANCST  RDSCNT    COQT   ELEVT    EXPT
     25000.      0.  200.00  975.00     .50  100.00   .0230   .0504    0.00  975.00    0.00

     CAPACITY=        0.     2500.     4000.     5200.     6800.     9000.    11500.    15500.    21000.    30000.
    ELEVATION=      965.     1000.     1015.     1030.     1045.     1060.     1075.     1090.     1105.     1120.
         COST=        0.     1500.     2400.     3000.     3600.     4350.     4950.     5550.     6000.     7200.

 OUTLET CREST ELEVATION IS 1060.71 AT STORAGE OF      9119.

                                 SYNTHETIC STORAGE OUTFLOW FUNCTION
     STORAGE=      714.     1097.     2245.     4657.     9119.    13098.    16565.    20279.    25089.    30000.
     OUTFLOW=        0.      463.      926.     1389.     1852.    11109.    20432.    29653.    38860.    48060.

                               STATION     110, PLAN 2, RTIO 1

                                          OUTFLOW
           6.        6.        6.        6.        7.        8.       10.       16.       25.       36.
          47.       59.       71.       83.       94.      106.      119.      136.      161.      204.
         267.      344.      426.      479.      507.      534.      556.      573.      584.      590.
         590.      588.      582.      575.      565.      554.      541.      528.      514.      500.
         485.      471.      445.      405.      369.      335.      305.      277.      252.      229.
         208.      189.      172.      157.      142.      130.      118.      107.       98.       89.

                                           STOR
         719.      719.      719.      719.      720.      721.      723.      727.      735.      744.
         753.      763.      773.      783.      792.      802.      813.      826.      847.      883.
         935.      996.     1067.     1137.     1207.     1272.     1327.     1369.     1397.     1411.
        1413.     1406.     1393.     1374.     1350.     1322.     1291.     1258.     1224.     1188.
        1153.     1117.     1082.     1049.     1019.      991.      966.      983.      923.      904.
         886.      871.      857.      844.      832.      821.      812.      803.      795.      788.

                             PEAK    6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                  CFS        590.      585.       513.       276.          16586.
                  CMS         17.       17.        15.         8.            470.
               INCHES                  .15        .54        .73             .73
                   MM                 3.94      13.80      18.61           18.61
                AC-FT                 290.      1017.      1371.           1371.
          THOUS CU M                  358.      1255.      1692.           1692.

                              MAXIMUM STORAGE =      1413.
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Exhibit 3
7 of 43

STATION 110, PLAN 2, RTIO 2

OUTFLOW

7.	7.	7.	7.	8.	9.	12.	19.	30.	43.
57.	71.	85.	99.	113.	127.	143.	163.	193.	285.
321.	413.	480.	515.	551.	585.	613.	635.	650.	659.
661.	659.	654.	647.	637.	624.	611.	596.	581.	565.
589.	533.	516.	501.	485.	470.	440.	400.	363.	330.
300.	272.	247.	225.	204.	186.	169.	154.	140.	127.

STOR

720.	720.	720.	720.	721.	722.	724.	730.	739.	750.
761.	773.	785.	796.	808.	820.	833.	849.	874.	917.
980.	1055.	1138.	1227.	1316.	1399.	1469.	1524.	1562.	1582.
1589.	1584.	1572.	1553.	1528.	1498.	1464.	1427.	1389.	1349.
1310.	1270.	1230.	1190.	1152.	1114.	1078.	1045.	1014.	987.
962.	939.	919.	900.	883.	866.	854.	841.	830.	819.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	661.	655.	582.	329.	19711.
CMS	19.	19.	16.	9.	558.
INCHES		.17	.62	.87	.87
MM		4.41	15.68	22.11	22.11
AC-FT		325.	1156.	1630.	1630.
THOUS CU M		401.	1425.	2010.	2010.

MAXIMUM STORAGE = 1589.

STATION 110, PLAN 2, RTIO 3

OUTFLOW

12.	12.	12.	12.	13.	15.	20.	32.	50.	71.
94.	118.	142.	165.	189.	212.	239.	271.	322.	408.
485.	542.	603.	669.	735.	797.	850.	893.	923.	934.
939.	940.	938.	934.	929.	916.	897.	876.	854.	832.
808.	785.	762.	738.	716.	693.	672.	650.	630.	610.
591.	572.	554.	536.	519.	503.	487.	471.	443.	402.

STOR

724.	724.	724.	724.	725.	727.	731.	741.	756.	773.
792.	812.	831.	851.	870.	890.	912.	939.	980.	1052.
1158.	1293.	1445.	1608.	1772.	1925.	2057.	2163.	2239.	2287.
2311.	2317.	2309.	2290.	2259.	2219.	2173.	2122.	2068.	2011.
1954.	1896.	1838.	1780.	1723.	1668.	1614.	1562.	1511.	1462.
1414.	1368.	1323.	1279.	1237.	1196.	1156.	1117.	1081.	1047.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	940.	936.	835.	517.	31041.
CMS	27.	26.	24.	15.	879.
INCHES		.25	.88	1.37	1.37
MM		6.30	22.47	34.83	34.83
AC-FT		464.	1656.	2567.	2567.
THOUS CU M		572.	2043.	3166.	3166.

MAXIMUM STORAGE = 2317.

STATION 110, PLAN 2, RTIO 4

OUTFLOW

17.	17.	17.	17.	18.	21.	28.	44.	70.	100.
132.	165.	198.	232.	264.	297.	334.	380.	451.	500.
554.	643.	733.	829.	925.	969.	1007.	1038.	1062.	1079.
1049.	1094.	1095.	1093.	1089.	1081.	1072.	1061.	1049.	1036.
1022.	1008.	994.	979.	965.	951.	936.	918.	889.	861.
834.	807.	782.	757.	733.	710.	687.	665.	644.	623.

STOR

728.	728.	728.	729.	729.	732.	738.	751.	772.	797.
824.	851.	878.	906.	933.	960.	990.	1028.	1087.	1190.
1347.	1544.	1767.	2005.	2243.	2467.	2666.	2830.	2955.	3041.
3094.	3121.	3128.	3118.	3093.	3055.	3005.	2948.	2885.	2818.
2747.	2674.	2600.	2524.	2449.	2374.	2299.	2226.	2154.	2085.
2017.	1951.	1888.	1826.	1766.	1709.	1653.	1598.	1546.	1495.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1095.	1090.	1025.	661.	39676.
CMS	31.	31.	29.	19.	1124.
INCHES		.29	1.09	1.75	1.75
MM		7.34	27.61	44.51	44.51
AC-FT		541.	2035.	3281.	3281.
THOUS CU M		667.	2510.	4047.	4047.

MAXIMUM STORAGE = 3128.

STATION 110, PLAN 2, RTIO 5

OUTFLOW

24.	24.	24.	25.	26.	30.	40.	63.	100.	143.
189.	236.	284.	331.	377.	425.	468.	491.	527.	591.
685.	803.	930.	998.	1066.	1132.	1191.	1239.	1277.	1305.
1323.	1334.	1340.	1340.	1337.	1330.	1320.	1308.	1294.	1278.
1262.	1245.	1228.	1210.	1192.	1175.	1157.	1140.	1123.	1106.
1089.	1073.	1056.	1040.	1024.	1009.	993.	978.	965.	948.

STOR

734.	734.	734.	735.	736.	739.	748.	767.	797.	832.
870.	909.	949.	988.	1026.	1065.	1109.	1166.	1256.	1413.
1608.	1940.	2268.	2620.	2978.	3320.	3625.	3879.	4077.	4220.
4315.	4372.	4401.	4406.	4388.	4351.	4298.	4234.	4161.	4082.
3997.	3909.	3818.	3726.	3634.	3542.	3451.	3361.	3272.	3183.
3096.	3010.	2925.	2841.	2758.	2677.	2597.	2517.	2439.	2362.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1340.	1334.	1253.	838.	50260.
CMS	38.	38.	35.	24.	1423.
INCHES		.35	1.33	2.22	2.22
MM		8.98	33.75	56.39	56.39
AC-FT		662.	2487.	4156.	4156.
THOUS CU M		816.	3068.	5126.	5126.

MAXIMUM STORAGE = 4406.

STATION 110, PLAN 2, RTIO 6

OUTFLOW

36.	36.	36.	37.	39.	45.	61.	95.	150.	214.
283.	354.	425.	474.	499.	526.	557.	596.	655.	754.
901.	1000.	1099.	1205.	1313.	1403.	1453.	1496.	1530.	1556.
1574.	1586.	1594.	1599.	1599.	1597.	1592.	1585.	1577.	1568.
1558.	1547.	1535.	1524.	1512.	1500.	1488.	1476.	1464.	1452.
1440.	1428.	1417.	1405.	1393.	1376.	1355.	1334.	1314.	1294.

STOR

744.	744.	744.	745.	747.	752.	764.	793.	838.	891.
948.	1007.	1066.	1125.	1187.	1253.	1329.	1426.	1573.	1820.
2182.	2634.	3147.	3699.	4260.	4797.	5280.	5690.	6018.	6265.
6441.	6561.	6639.	6680.	6687.	6665.	6618.	6554.	6475.	6385.
6286.	6181.	6071.	5958.	5843.	5728.	5612.	5497.	5381.	5267.
5152.	5038.	4925.	4813.	4701.	4591.	4481.	4374.	4267.	4163.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1599.	1595.	1540.	1059.	63511.
CMS	45.	45.	44.	30.	1798.
INCHES		.42	1.63	2.81	2.81
MM		10.73	41.47	71.25	71.25
AC-FT		791.	3056.	5252.	5252.
THOUS CU M		976.	3770.	6478.	6478.

MAXIMUM STORAGE = 6687.

STATION 110, PLAN 2, RTIO 7

OUTFLOW

53.	53.	53.	54.	58.	66.	89.	140.	219.	314.
415.	482.	520.	559.	600.	643.	692.	754.	845.	959.
1064.	1195.	1344.	1451.	1539.	1625.	1702.	1768.	1821.	2080.
2669.	2983.	3113.	3105.	2993.	2808.	2580.	2333.	2083.	1851.
1840.	1828.	1815.	1801.	1787.	1774.	1760.	1746.	1732.	1718.
1704.	1690.	1676.	1663.	1649.	1636.	1622.	1609.	1596.	1582.

STOR

758.	758.	758.	759.	762.	769.	788.	830.	896.	974.
1058.	1145.	1237.	1335.	1436.	1544.	1666.	1818.	2043.	2416.
2964.	3648.	4423.	5257.	6109.	6930.	7674.	8311.	8627.	9216.
9667.	9601.	9656.	9653.	9605.	9526.	9429.	9324.	9217.	9113.
9006.	8888.	8763.	8633.	8501.	8366.	8232.	8097.	7963.	7829.
7695.	7561.	7429.	7297.	7166.	7036.	6907.	6778.	6650.	6524.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3113.	2945.	2154.	1398.	83898.
CMS	88.	83.	61.	40.	2376.
INCHES		.78	2.28	3.71	3.71
MM		19.83	57.99	94.13	94.13
AC-FT		1461.	4274.	6937.	6937.
THOUS CU M		1802.	5272.	8557.	8557.

MAXIMUM STORAGE = 9656.

STATION 110, PLAN 2, RTIO 8

OUTFLOW

78.	78.	78.	80.	85.	98.	131.	206.	324.	463.
515.	571.	630.	693.	758.	826.	903.	960.	1027.	1137.
1297.	1446.	1568.	1700.	1834.	4171.	6220.	7586.	8345.	8608.
8499.	8157.	7686.	7129.	6513.	5870.	5229.	4613.	4038.	3509.
3031.	2603.	2223.	1892.	1840.	1826.	1812.	1798.	1784.	1770.
1756.	1742.	1729.	1715.	1701.	1687.	1674.	1660.	1647.	1633.

STOR

779.	779.	779.	780.	785.	795.	823.	885.	982.	1098.
1226.	1365.	1512.	1667.	1828.	1997.	2188.	2424.	2773.	3344.
4177.	5212.	6387.	7658.	8949.	10107.	10980.	11502.	11886.	11998.
11951.	11806.	11605.	11367.	11105.	10831.	10558.	10295.	10050.	9825.
9621.	9439.	9277.	9136.	9005.	8872.	8739.	8605.	8470.	8336.
8201.	8067.	7933.	7800.	7667.	7535.	7404.	7274.	7145.	7016.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8608.	8147.	4793.	2520.	151184.
CMS	244.	231.	136.	71.	4281.
INCHES		2.16	5.08	6.68	6.68
MM		54.84	129.06	169.62	169.62
AC-FT		4042.	9512.	12501.	12501.
THOUS CU M		4985.	11733.	15420.	15420.

MAXIMUM STORAGE = 11998.

STATION 110, PLAN 2, RTIO 9

RESERVOIR	CAP COST	TOT ANN $
9118.6	4378.	321.

OUTFLOW

106.	106.	106.	108.	115.	133.	178.	279.	439.	520.
593.	672.	756.	844.	930.	976.	1028.	1093.	1187.	1338.
1480.	1628.	1796.	4450.	7836.	10523.	12588.	13836.	14282.	14089.
13441.	12537.	11525.	10536.	9546.	8547.	7573.	6652.	5801.	5026.
4330.	3710.	3163.	2688.	2279.	1932.	1841.	1828.	1814.	1800.
1786.	1773.	1759.	1745.	1731.	1718.	1704.	1691.	1677.	1664.

STOR

802.	802.	802.	804.	810.	824.	861.	945.	1077.	1238.
1420.	1616.	1825.	2042.	2267.	2507.	2778.	3114.	3604.	4394.
5541.	6967.	8586.	10226.	11669.	12814.	13623.	14091.	14258.	14185.
13942.	13603.	13224.	12819.	12398.	11972.	11557.	11164.	10801.	10471.
10175.	9911.	9678.	9475.	9301.	9153.	9020.	8888.	8756.	8624.
8490.	8357.	8225.	8092.	7960.	7829.	7698.	7568.	7438.	7309.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14282.	13462.	7864.	3797.	227836.
CMS	404.	381.	223.	108.	6452.
INCHES		3.57	8.34	10.06	10.06
MM		90.62	211.75	255.62	255.62
AC-FT		6679.	15606.	18839.	18839.
THOUS CU M		8238.	19250.	23238.	23238.

MAXIMUM STORAGE = 14258.

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HYDROGRAPH ROUTING

POTENTIAL CHANNEL MODIFICATION REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6300.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 1030, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	289.	17369.
CMS	27.	26.	17.	8.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

MAXIMUM STORAGE = 434.

STATION 1030, PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

STATION 1030, PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1940.	1859.	1220.	579.	34733.
CMS	55.	53.	35.	16.	984.
INCHES		.49	1.29	1.53	1.53
MM		12.52	32.84	38.97	38.97
AC-FT		922.	2420.	2872.	2872.
THOUS CU M		1138.	2985.	3543.	3543.

MAXIMUM STORAGE = 890.

STATION 1030, PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2921.	2743.	1715.	810.	48621.
CMS	83.	78.	49.	23.	1377.
INCHES		.73	1.82	2.15	2.15
MM		18.47	46.18	54.55	54.55
AC-FT		1361.	3403.	4020.	4020.
THOUS CU M		1679.	4198.	4959.	4959.

MAXIMUM STORAGE = 1197.

STATION 1030, PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4312.	4092.	2471.	1158.	69450.
CMS	122.	116.	70.	33.	1967.
INCHES		1.08	2.62	3.07	3.07
MM		27.55	66.54	77.92	77.92
AC-FT		2030.	4904.	5743.	5743.
THOUS CU M		2504.	6049.	7083.	7083.

MAXIMUM STORAGE = 1607.

STATION 1030, PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6699.	6289.	3747.	1756.	104156.
CMS	190.	178.	106.	49.	2949.
INCHES		1.67	3.97	4.60	4.60
MM		42.34	100.88	116.86	116.86
AC-FT		3120.	7435.	8612.	8612.
THOUS CU M		3849.	9171.	10623.	10623.

MAXIMUM STORAGE = 2271.

STATION 1030, PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10191.	9555.	5550.	2545.	152725.
CMS	289.	271.	157.	72.	4325.
INCHES		2.53	5.88	6.75	6.75
MM		64.32	149.44	171.35	171.35
AC-FT		4741.	11014.	12628.	12628.
THOUS CU M		5848.	13585.	15577.	15577.

MAXIMUM STORAGE = 3067.

STATION 1030, PLAN 1, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15177.	14262.	8279.	3759.	225518.
CMS	430.	404.	234.	106.	6386.
INCHES		3.78	8.78	9.96	9.96
MM		96.00	222.93	253.02	253.02
AC-FT		7076.	16430.	18647.	18647.
THOUS CU M		8728.	20266.	23001.	23001.

MAXIMUM STORAGE = 4234.

STATION 1030, PLAN 1, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20603.	19364.	11267.	5087.	305199.
CMS	583.	548.	319.	144.	8642.
INCHES		5.13	11.94	13.48	13.48
MM		130.35	303.38	342.41	342.41
AC-FT		9607.	22359.	25236.	25236.
THOUS CU M		11850.	27580.	31128.	31128.

MAXIMUM STORAGE = 5505.

STATION 1030, PLAN 2, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	529.	526.	472.	269.	16149.
CMS	15.	15.	13.	8.	457.
INCHES		.14	.50	.71	.71
MM		3.54	12.70	18.12	18.12
AC-FT		261.	936.	1335.	1335.
THOUS CU M		322.	1154.	1647.	1647.

MAXIMUM STORAGE = 221.

STATION 1030, PLAN 2, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	593.	590.	539.	315.	18904.
CMS	17.	17.	15.	9.	535.
INCHES		.16	.57	.84	.84
MM		3.97	14.51	21.21	21.21
AC-FT		293.	1069.	1563.	1563.
THOUS CU M		361.	1319.	1928.	1928.

MAXIMUM STORAGE = 254.

STATION 1030, PLAN 2, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	853.	847.	781.	473.	28405.
CMS	24.	24.	22.	13.	804.
INCHES		.22	.83	1.25	1.25
MM		5.71	21.02	31.87	31.87
AC-FT		420.	1549.	2349.	2349.
THOUS CU M		519.	1911.	2897.	2897.

MAXIMUM STORAGE = 388.

STATION 1030, PLAN 2, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1018.	1015.	966.	595.	35697.
CMS	29.	29.	27.	17.	1011.
INCHES		.27	1.02	1.58	1.58
MM		6.83	26.00	40.05	40.05
AC-FT		504.	1917.	2952.	2952.
THOUS CU M		621.	2364.	3641.	3641.

MAXIMUM STORAGE = 474.

STATION 1030, PLAN 2, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1260.	1255.	1196.	743.	44564.
CMS	36.	36.	34.	21.	1262.
INCHES		.33	1.27	1.97	1.97
MM		8.45	32.22	50.00	50.00
AC-FT		623.	2374.	3685.	3685.
THOUS CU M		768.	2929.	4545.	4545.

MAXIMUM STORAGE = 583.

STATION 1030, PLAN 2, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1535.	1532.	1491.	932.	55937.
CMS	43.	43.	42.	26.	1584.
INCHES		.41	1.58	2.47	2.47
MM		10.31	40.14	62.76	62.76
AC-FT		760.	2958.	4625.	4625.
THOUS CU M		937.	3649.	5705.	5705.

MAXIMUM STORAGE = 707.

STATION 1030, PLAN 2, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2601.	2505.	2078.	1247.	74837.
CMS	74.	71.	59.	35.	2119.
INCHES		.66	2.20	3.31	3.31
MM		16.87	55.96	83.96	83.96
AC-FT		1243.	4124.	6188.	6188.
THOUS CU M		1533.	5087.	7633.	7633.

MAXIMUM STORAGE = 1103.

STATION 1030, PLAN 2, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7263.	6959.	4622.	2363.	141772.
CMS	206.	197.	131.	67.	4015.
INCHES		1.84	4.90	6.26	6.26
MM		46.84	124.44	159.06	159.06
AC-FT		3452.	9171.	11723.	11723.
THOUS CU M		4259.	11313.	14460.	14460.

MAXIMUM STORAGE = 2400.

STATION 1030, PLAN 2, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12276.	11802.	7596.	3637.	218226.
CMS	348.	334.	215.	103.	6179.
INCHES		3.13	8.05	9.64	9.64
MM		79.45	204.52	244.83	244.83
AC-FT		5855.	15074.	18044.	18044.
THOUS CU M		7222.	18593.	22258.	22258.

MAXIMUM STORAGE = 3555.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLUD	NDMG	ISAME	TRGT	DGPRT	IAQST	ADSCNT	AANCST	ILPR
1030	16	3	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1130.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4830.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	[illegible]	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8540.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15100.	44.300	1.500	15.000	27.800
.005	21100.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.98	.07	.30	.61
3	1940.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4512.	.867	.785	7.73	.33	2.28	5.12
6	6679.	.323	.391	6.53	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.49
8	19177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.50	1.59	10.02	21.97

FLOOD DAMAGES FOR STATION 1030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	529.	6.000	.284	0.00	0.00	0.00	0.00
2	593.	5.462	1.752	0.00	0.00	0.00	0.00
3	853.	3.097	1.776	0.00	0.00	0.00	0.00
4	1018.	1.769	1.072	0.00	0.00	0.00	0.00
5	1260.	.867	.785	.65	.04	.20	.39
6	1535.	.323	.391	.84	.06	.25	.52
7	2601.	.095	.136	.88	.04	.26	.57
8	7263.	.020	.037	.68	.03	.19	.46
9	12276.	.006	.014	.44	.02	.13	.30
		AVG ANN DMG		3.46	.19	1.03	2.24
		AVG ANN BFT		30.12	1.40	8.99	19.73

```
                              SUB-AREA RUNOFF COMPUTATION
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       20       0       0       2       0       0       0       0       0

                       PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                       PLAN 1,RATIO 1
         6.        6.        7.        8.       13.       21.       48.       94.      129.      148.
       165.      176.      190.      200.      210.      228.      260.      323.      480.      750.
       987.     1150.     1270.     1340.     1343.     1275.     1150.      995.      833.      680.
       550.      460.      385.      313.      249.      194.      151.      116.       91.       70.
        54.       40.       30.       24.       19.       17.       15.       13.       12.       11.
        10.       10.        9.        8.        8.        8.        7.        7.        6.        6.


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                                     HYDROGRAPH ROUTING

                POTENTIAL LEVEE AND/OR BYPASS REACH
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                     2030       1       1       0       0       0       1       0       0

                                     ALL PLANS HAVE SAME
                                        ROUTING DATA
                QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
                  0.0   0.000    0.00       1       1       0       0       0       0

                    NSTPS   NSTDL     LAG   AMSKK       X     TSK    STORA
                        1       0       0   0.000   0.000   0.000     -1.

STORAGE=         0.        50.       475.       940.      2135.      3060.      6300.         0.         0.         0.
OUTFLOW=         0.       200.      1020.      2050.      6100.     10250.     24000.         0.         0.         0.

                              STATION    2030, PLAN 1, RTIO 1

                       PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
               CFS     941.      907.      613.      289.         17369.
               CMS      27.       26.       17.        8.           492.
            INCHES                .24       .65       .77            .77
                MM               6.10     16.51     19.49          19.49
             AC-FT               450.     1217.     1436.          1436.
         THOUS CU M              555.     1501.     1772.          1772.


                              MAXIMUM STORAGE =      434.
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STATION 2030, PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

STATION 2030, PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1940.	1659.	1220.	579.	34735.
CMS	55.	53.	35.	16.	984.
INCHES		.49	1.29	1.53	1.53
MM		12.52	32.84	38.97	38.97
AC-FT		922.	2420.	2872.	2872.
THOUS CU M		1138.	2985.	3543.	3543.

MAXIMUM STORAGE = 890.

STATION 2030, PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2921.	2743.	1715.	810.	48621.
CMS	83.	78.	49.	23.	1377.
INCHES		.73	1.82	2.15	2.15
MM		18.47	46.18	54.55	54.55
AC-FT		1361.	3403.	4020.	4020.
THOUS CU M		1679.	4198.	4959.	4959.

MAXIMUM STORAGE = 1197.

STATION 2030, PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4312.	4092.	2471.	1158.	69450.
CMS	122.	116.	70.	33.	1967.
INCHES		1.08	2.62	3.07	3.07
MM		27.55	66.54	77.92	77.92
AC-FT		2030.	4904.	5743.	5743.
THOUS CU M		2504.	6049.	7083.	7083.

MAXIMUM STORAGE = 1607.

STATION 2030, PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6699.	6289.	3747.	1736.	104156.
CMS	190.	178.	106.	49.	2949.
INCHES		1.67	3.97	4.60	4.60
MM		42.34	100.88	116.86	116.86
AC-FT		3120.	7435.	8612.	8612.
THOUS CU M		3849.	9171.	10623.	10623.

MAXIMUM STORAGE = 2271.

STATION 2030, PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10191.	9555.	5550.	2545.	152725.
CMS	289.	271.	157.	72.	4325.
INCHES		2.53	5.88	6.75	6.75
MM		64.32	149.44	171.35	171.35
AC-FT		4741.	11014.	12628.	12628.
THOUS CU M		5848.	13585.	15577.	15577.

MAXIMUM STORAGE = 3067.

STATION 2030, PLAN 1, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15177.	14262.	8279.	3759.	225518.
CMS	430.	404.	234.	106.	6386.
INCHES		3.78	8.78	9.96	9.96
MM		96.00	222.93	253.02	253.02
AC-FT		7076.	16430.	18647.	18647.
THOUS CU M		8728.	20266.	23001.	23001.

MAXIMUM STORAGE = 4234.

STATION 2030, PLAN 1, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20603.	19364.	11267.	5087.	305199.
CMS	583.	548.	319.	144.	8642.
INCHES		5.13	11.94	13.48	13.48
MM		130.35	303.38	342.41	342.41
AC-FT		9607.	22359.	25236.	25236.
THOUS CU M		11850.	27580.	31128.	31128.

MAXIMUM STORAGE = 5505.

STATION 2030, PLAN 2, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	289.	17369.
CMS	27.	26.	17.	8.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

MAXIMUM STORAGE = 434.

STATION 2030, PLAN 2, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

STATION 2030, PLAN 2, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1940.	1859.	1220.	579.	34733.
CMS	55.	53.	35.	16.	984.
INCHES		.49	1.29	1.53	1.53
MM		12.52	32.84	38.97	38.97
AC-FT		922.	2420.	2872.	2872.
THOUS CU M		1138.	2985.	3543.	3543.

MAXIMUM STORAGE = 890.

STATION 2030, PLAN 2, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2921.	2743.	1715.	810.	48621.
CMS	83.	78.	49.	23.	1377.
INCHES		.73	1.82	2.15	2.15
MM		18.47	46.18	54.55	54.55
AC-FT		1361.	3403.	4020.	4020.
THOUS CU M		1679.	4198.	4959.	4959.

MAXIMUM STORAGE = 1197.

STATION 2030, PLAN 2, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4312.	4092.	2471.	1158.	69450.
CMS	122.	116.	70.	33.	1967.
INCHES		1.08	2.62	3.07	3.07
MM		27.55	66.54	77.92	77.92
AC-FT		2030.	4904.	5743.	5743.
THOUS CU M		2504.	6049.	7083.	7083.

MAXIMUM STORAGE = 1607.

STATION 2030, PLAN 2, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6499.	6289.	3747.	1736.	104156.
CMS	190.	178.	106.	49.	2949.
INCHES		1.67	3.97	4.60	4.60
MM		42.34	100.88	116.86	116.86
AC-FT		3120.	7435.	8612.	8612.
THOUS CU M		3849.	9171.	10623.	10623.

MAXIMUM STORAGE = 2271.

STATION 2030, PLAN 2, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10191.	9555.	5550.	2545.	152725.
CMS	289.	271.	157.	72.	4325.
INCHES		2.53	5.88	6.75	6.75
MM		64.32	149.44	171.35	171.35
AC-FT		4741.	11014.	12628.	12628.
THOUS CU M		5848.	13585.	15577.	15577.

MAXIMUM STORAGE = 3067.

STATION 2030, PLAN 2, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15177.	14262.	8279.	3759.	225518.
CMS	430.	404.	234.	106.	6386.
INCHES		3.78	8.78	9.96	9.96
MM		96.00	222.93	253.02	253.02
AC-FT		7076.	16430.	18647.	18647.
THOUS CU M		8728.	20266.	23001.	23001.

MAXIMUM STORAGE = 4234.

STATION 2030, PLAN 2, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20603.	19364.	11267.	5087.	305199.
CMS	583.	548.	319.	144.	8642.
INCHES		5.13	11.94	13.48	13.48
MM		130.35	303.38	342.41	342.41
AC-FT		9607.	22359.	25236.	25236.
THOUS CU M		11850.	27580.	31128.	31128.

MAXIMUM STORAGE = 5505.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IAQST	ADSCNT	AANCST	ILPR
2030	16	1	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.600	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6490.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1980.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.765	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1980.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.765	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58
		AVG ANN BFT		.00	0.00

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	0	0	2	0	0	1	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1,RATIO 1

2.	2.	2.	3.	4.	7.	16.	31.	43.	49.
55.	58.	64.	66.	70.	76.	88.	106.	160.	250.
330.	385.	413.	450.	453.	423.	383.	333.	278.	225.
183.	154.	129.	104.	83.	64.	50.	39.	30.	23.
18.	14.	10.	8.	7.	6.	5.	5.	4.	4.
3.	3.	3.	3.	3.	3.	3.	2.	2.	2.

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COMBINE HYDROGRAPHS

COMBINED INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	3	0	0	0	0	1	0	0

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2219.	2137.	1433.	675.	40523.
CMS	63.	61.	41.	19.	1147.
INCHES		.25	.66	.78	.78
MM		6.30	16.89	19.90	19.90
AC-FT		1060.	2848.	3351.	3351.
THOUS CU M		1308.	3508.	4133.	4133.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2676.	2571.	1713.	810.	48626.
CMS	76.	73.	49.	23.	1377.
INCHES		.30	.79	.94	.94
MM		7.57	20.19	23.88	23.88
AC-FT		1275.	3400.	4021.	4021.
THOUS CU M		1573.	4194.	4960.	4960.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4563.	4375.	2851.	1351.	81034.
CMS	129.	124.	81.	38.	2295.
INCHES		.51	1.32	1.57	1.57
MM		12.89	33.60	39.79	39.79
AC-FT		2171.	5658.	6700.	6700.
THOUS CU M		2678.	6980.	8265.	8265.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6859.	6463.	4009.	1891.	113438.
CMS	194.	183.	114.	54.	3212.
INCHES		.75	1.86	2.19	2.19
MM		19.04	47.25	55.70	55.70
AC-FT		3207.	7957.	9380.	9380.
THOUS CU M		3955.	9815.	11570.	11570.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10154.	9579.	5772.	2701.	162037.
CMS	288.	271.	163.	76.	4588.
INCHES		1.11	2.68	3.13	3.13
MM		28.22	68.03	79.56	79.56
AC-FT		4752.	11455.	13398.	13398.
THOUS CU M		5862.	14130.	16527.	16527.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15693.	14690.	8750.	4050.	243018.
CMS	444.	416.	248.	115.	6881.
INCHES		1.70	4.06	4.70	4.70
MM		43.28	103.12	119.33	119.33
AC-FT		7288.	17365.	20094.	20094.
THOUS CU M		8989.	21420.	24786.	24786.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	23748.	22393.	12956.	5939.	356352.
CMS	672.	634.	367.	168.	10091.
INCHES		2.60	6.01	6.89	6.89
MM		65.97	152.68	174.98	174.98
AC-FT		11110.	25712.	29466.	29466.
THOUS CU M		13704.	31715.	36345.	36345.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	35345.	33502.	19329.	8771.	526232.
CMS	1001.	949.	547.	248.	14901.
INCHES		3.89	8.97	10.17	10.17
MM		98.70	227.78	258.39	258.39
AC-FT		16621.	38357.	43513.	43513.
THOUS CU M		20502.	47313.	53672.	53672.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	48011.	45517.	26298.	11870.	712202.
CMS	1360.	1289.	745.	336.	20167.
INCHES		5.26	12.20	13.77	13.77
MM		134.10	309.90	349.71	349.71
AC-FT		22582.	52188.	58890.	58890.
THOUS CU M		27854.	64372.	72640.	72640.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1664.	1616.	1226.	655.	39303.
CMS	47.	46.	35.	19.	1113.
INCHES		.19	.57	.76	.76
MM		4.76	14.45	19.30	19.30
AC-FT		802.	2434.	3250.	3250.
THOUS CU M		989.	3002.	4009.	4009.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1968.	1906.	1434.	778.	46688.
CMS	56.	54.	41.	22.	1322.
INCHES		.22	.67	.90	.90
MM		5.62	16.90	22.92	22.92
AC-FT		946.	2846.	3860.	3860.
THOUS CU M		1166.	3511.	4762.	4762.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3196.	3092.	2266.	1245.	74707.
CMS	91.	88.	64.	35.	2115.
INCHES		.36	1.05	1.44	1.44
MM		9.11	26.70	36.68	36.68
AC-FT		1534.	4496.	6177.	6177.
THOUS CU M		1892.	5546.	7620.	7620.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4616.	4394.	3049.	1675.	100514.
CMS	131.	124.	86.	47.	2846.
INCHES		.51	1.41	1.94	1.94
MM		12.94	35.93	49.35	49.35
AC-FT		2180.	6051.	8311.	8311.
THOUS CU M		2689.	7464.	10252.	10252.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6625.	6299.	4218.	2286.	137152.
CMS	188.	178.	119.	65.	3884.
INCHES		.73	1.96	2.65	2.65
MM		18.56	49.70	67.34	67.34
AC-FT		3125.	8370.	11341.	11341.
THOUS CU M		3855.	10324.	13989.	13989.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9960.	9428.	6100.	3247.	194798.
CMS	282.	267.	173.	92.	5516.
INCHES		1.09	2.83	3.77	3.77
MM		27.78	71.89	95.65	95.65
AC-FT		4678.	12106.	16107.	16107.
THOUS CU M		5770.	14932.	19868.	19868.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14769.	14017.	8974.	4641.	278464.
CMS	418.	397.	254.	131.	7885.
INCHES		1.63	4.16	5.38	5.38
MM		41.30	105.75	136.73	136.73
AC-FT		6954.	17809.	23025.	23025.
THOUS CU M		8578.	21967.	28401.	28401.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	22446.	21805.	14977.	7375.	442485.
CMS	636.	617.	424.	209.	12530.
INCHES		2.53	6.95	8.55	8.55
MM		64.24	176.50	217.27	217.27
AC-FT		10818.	29723.	36588.	36588.
THOUS CU M		13344.	36662.	45131.	45131.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 2 RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	34011.	32584.	21704.	10420.	625228.
CMS	963.	923.	615.	295.	17704.
INCHES		3.78	10.07	12.09	12.09
MM		96.00	255.77	307.00	307.00
AC-FT		16166.	43071.	51698.	51698.
THOUS CU M		19940.	53127.	63769.	63769.

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HYDROGRAPH ROUTING

PROPOSED PUMPING PLANT SITE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
305	1	1	0	0	2	1	0	0

PLAN 1
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	0	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

STATION 305, PLAN 1, RTIO 1

OUTFLOW

14.	14.	14.	14.	15.	17.	22.	33.	53.	81.
114.	150.	187.	225.	262.	298.	335.	374.	421.	492.
597.	735.	897.	1078.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1069.	655.
683.	546.	437.	350.	280.	225.	181.	147.	119.	97.

STOR

5.	5.	5.	5.	5.	6.	7.	11.	18.	27.
38.	50.	62.	75.	87.	99.	112.	125.	140.	164.
199.	245.	299.	359.	425.	499.	581.	665.	746.	821.
885.	939.	981.	1011.	1030.	1036.	1032.	1017.	992.	958.
916.	867.	811.	749.	681.	606.	525.	439.	356.	285.
228.	182.	146.	117.	93.	75.	60.	49.	40.	32.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	670.	40227.
CMS	34.	34.	34.	19.	1139.
INCHES		.14	.56	.78	.78
MM		3.54	14.14	19.75	19.75
AC-FT		595.	2381.	3326.	3326.
THOUS CU M		734.	2937.	4103.	4103.

MAXIMUM STORAGE = 1036.

STATION 305, PLAN 1, RTIO 2

OUTFLOW

17.	17.	17.	17.	18.	20.	26.	40.	64.	97.
137.	180.	225.	270.	314.	355.	394.	435.	489.	572.
698.	863.	1059.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1105.	870.	685.	541.	427.	338.

STOR

6.	6.	6.	6.	6.	7.	9.	13.	21.	32.
46.	60.	75.	90.	105.	118.	131.	145.	163.	191.
233.	288.	353.	429.	521.	629.	747.	869.	988.	1098.
1195.	1278.	1347.	1403.	1444.	1471.	1485.	1486.	1475.	1454.
1423.	1384.	1337.	1283.	1223.	1156.	1083.	1003.	919.	831.
740.	648.	554.	460.	368.	290.	228.	180.	142.	113.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	791.	47487.
CMS	34.	34.	34.	22.	1345.
INCHES		.14	.56	.92	.92
MM		3.54	14.14	23.32	23.32
AC-FT		595.	2381.	3927.	3927.
THOUS CU M		734.	2937.	4843.	4843.

MAXIMUM STORAGE = 1486.

STATION 305, PLAN 1, RTIO 3

OUTFLOW

28.	28.	28.	29.	30.	34.	43.	60.	106.	161.
227.	295.	359.	421.	479.	537.	597.	664.	754.	896.
1109.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

9.	9.	9.	10.	10.	11.	14.	22.	35.	54.
76.	98.	120.	140.	160.	179.	199.	221.	251.	299.
370.	471.	612.	798.	1025.	1280.	1553.	1830.	2100.	2355.
2587.	2794.	2976.	3132.	3262.	3367.	3448.	3509.	3551.	3577.
3587.	3583.	3567.	3540.	3504.	3459.	3407.	3349.	3285.	3215.
3137.	3054.	2968.	2879.	2788.	2695.	2602.	2507.	2412.	2317.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	895.	53692.
CMS	34.	34.	34.	25.	1520.
INCHES		.14	.56	1.04	1.04
MM		3.54	14.14	26.36	26.36
AC-FT		595.	2381.	4440.	4440.
THOUS CU M		734.	2937.	5476.	5476.

MAXIMUM STORAGE = 3587.

STATION 305, PLAN 1, RTIO 4

OUTFLOW

39.	39.	39.	40.	42.	47.	61.	92.	148.	224.
307.	389.	471.	553.	634.	715.	800.	896.	1025.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

13.	13.	13.	13.	14.	16.	20.	31.	49.	75.
102.	130.	157.	184.	211.	238.	267.	299.	342.	410.
525.	703.	946.	1252.	1625.	2053.	2512.	2976.	3423.	3835.
4204.	4524.	4800.	5040.	5246.	5420.	5562.	5675.	5761.	5825.
5868.	5894.	5904.	5900.	5883.	5855.	5818.	5773.	5721.	5663.
5599.	5529.	5451.	5369.	5284.	5195.	5105.	5013.	4920.	4827.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	929.	55761.
CMS	34.	34.	34.	26.	1579.
INCHES		.14	.56	1.08	1.08
MM		3.54	14.14	27.38	27.38
AC-FT		595.	2381.	4611.	4611.
THOUS CU M		734.	2937.	5687.	5687.

MAXIMUM STORAGE = 5904.

STATION 305, PLAN 1, RTIO 5

OUTFLOW

56.	56.	56.	57.	60.	67.	87.	132.	210.	308.
412.	522.	635.	750.	866.	983.	1106.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

19.	19.	19.	19.	20.	22.	29.	44.	70.	103.
137.	174.	212.	250.	289.	328.	369.	417.	491.	620.
831.	1135.	1547.	2077.	2708.	3408.	4140.	4872.	5572.	6218.
6798.	7306.	7745.	8118.	8428.	8685.	8901.	9080.	9224.	9338.
9423.	9485.	9526.	9550.	9557.	9550.	9532.	9503.	9465.	9419.
9367.	9309.	9245.	9175.	9099.	9017.	8933.	8845.	8756.	8665.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	966.	57963.
CMS	34.	34.	34.	27.	1641.
INCHES		.14	.56	1.12	1.12
MM		3.54	14.14	28.46	28.46
AC-FT		595.	2381.	4793.	4793.
THOUS CU M		734.	2937.	5912.	5912.

MAXIMUM STORAGE = 9557.

STATION 305, PLAN 1, RTIO 6

OUTFLOW

84.	84.	84.	86.	90.	101.	130.	198.	304.	453.
580.	738.	906.	1079.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

28.	28.	28.	29.	30.	34.	43.	66.	101.	144.
193.	246.	302.	360.	420.	491.	581.	696.	858.	1107.
1489.	2045.	2781.	3683.	4723.	5861.	7047.	8220.	9343.	10367.
11286.	12099.	12807.	13416.	13931.	14357.	14703.	14980.	15206.	15392.
15541.	15657.	15743.	15805.	15846.	15869.	15876.	15870.	15853.	15825.
15784.	15744.	15693.	15636.	15574.	15507.	15434.	15355.	15273.	15188.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1002.	60096.
CMS	34.	34.	34.	28.	1702.
INCHES		.14	.56	1.16	1.16
MM		3.54	14.14	29.51	29.51
AC-FT		595.	2381.	4969.	4969.
THOUS CU M		734.	2937.	6129.	6129.

MAXIMUM STORAGE = 15876.

STATION 305, PLAN 1, RTIO 7

OUTFLOW

123.	123.	124.	125.	132.	148.	190.	281.	422.	601.
810.	1040.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

41.	41.	41.	42.	44.	49.	63.	94.	141.	200.
270.	347.	432.	534.	661.	812.	994.	1215.	1505.	1939.
2401.	3524.	4706.	6153.	7827.	9639.	11499.	13325.	15046.	16609.
17990.	19185.	20215.	21103.	21866.	22508.	23040.	23473.	23818.	24091.
24311.	24490.	24631.	24739.	24819.	24875.	24912.	24932.	24937.	24930.
24912.	24884.	24848.	24804.	24754.	24699.	24640.	24575.	24505.	24430.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1029.	61719.
CMS	34.	34.	34.	29.	1748.
INCHES		.14	.56	1.19	1.19
MM		3.54	14.14	30.31	30.31
AC-FT		595.	2381.	5103.	5103.
THOUS CU M		734.	2937.	6295.	6295.

MAXIMUM STORAGE = 24937.

STATION 305, PLAN 1, RTIO 8

OUTFLOW

182.	182.	183.	185.	195.	219.	279.	401.	594.	850.
1154.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

61.	61.	61.	62.	65.	73.	93.	134.	198.	283.
385.	510.	673.	876.	1115.	1392.	1714.	2106.	2625.	3372.
4448.	5935.	7848.	10135.	12719.	15483.	18305.	21067.	23671.	26042.
28144.	29974.	31546.	32878.	33992.	34924.	35707.	36356.	36885.	37310.
37644.	37905.	38115.	38283.	38414.	38514.	38588.	38640.	38675.	38694.
38699.	38692.	38674.	38648.	38614.	38573.	38526.	38474.	38418.	38357.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1054.	63224.
CMS	34.	34.	34.	30.	1790.
INCHES		.14	.56	1.22	1.22
MM		3.54	14.14	31.04	31.04
AC-FT		595.	2381.	5228.	5228.
THOUS CU M		734.	2937.	6448.	6448.

MAXIMUM STORAGE = 38699.

STATION 305, PLAN 1, RTIO 9

OUTFLOW

246.	246.	247.	251.	264.	296.	370.	523.	778.	1119.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

82.	82.	82.	84.	88.	99.	123.	174.	259.	373.
525.	729.	990.	1304.	1677.	2117.	2629.	3234.	4000.	5069.
6624.	8760.	11438.	14601.	18158.	21952.	25817.	29601.	33166.	36415.
39299.	41814.	43983.	45834.	47387.	48670.	49718.	50581.	51294.	51875.
52340.	52706.	52988.	53212.	53392.	53535.	53646.	53730.	53792.	53835.
53862.	53875.	53876.	53866.	53848.	53821.	53787.	53747.	53701.	53651.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1072.	64341.
CMS	34.	34.	34.	30.	1822.
INCHES		.14	.56	1.24	1.24
MM		3.54	14.14	31.59	31.59
AC-FT		595.	2381.	5320.	5320.
THOUS CU M		734.	2937.	6562.	6562.

MAXIMUM STORAGE = 53876.

PLAN 2
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IOVR	LSTR
0.0	0.000	0.00	1	0	0	9	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

PUMPING PLANT DATA

PMPMX	PMPMN	PMPON	PMHCST	PANCST	PDSCNT
10000.	0.	1500.	100.	.02300	.05040

CAPACITY=	0.	250.	500.	1000.	2000.	6000.	8000.	10000.	0.	0.
COST=	0.	670.	1000.	1600.	2300.	6000.	7860.	8670.	0.	0.

STATION 305, PLAN 2, RTIO 1

OUTFLOW

14.	14.	14.	14.	15.	16.	20.	28.	42.	60.
83.	107.	134.	161.	189.	217.	247.	279.	320.	381.
468.	579.	705.	840.	980.	1112.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1138.	1023.	921.	831.	752.	682.
620.	565.	516.	472.	433.	397.	365.	336.	308.	282.

STOR

5.	5.	5.	5.	5.	5.	7.	9.	14.	20.
26.	36.	45.	54.	63.	72.	82.	93.	107.	127.
156.	193.	235.	280.	327.	371.	411.	449.	486.	520.
548.	572.	589.	601.	607.	607.	601.	590.	573.	551.
524.	494.	459.	420.	379.	341.	307.	277.	251.	227.
207.	188.	172.	157.	144.	132.	122.	112.	103.	94.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1151.	638.	38278.
CMS	34.	34.	33.	18.	1084.
INCHES		.14	.53	.74	.74
MM		3.54	13.56	18.80	18.80
AC-FT		595.	2283.	3165.	3165.
THOUS CU M		734.	2817.	3904.	3904.

MAXIMUM STORAGE = 607.

STATION 305, PLAN 2, RTIO 2

OUTFLOW

17.	17.	17.	17.	18.	19.	23.	33.	50.	72.
99.	129.	161.	194.	227.	259.	292.	329.	376.	448.
552.	683.	831.	991.	1155.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1069.	925.	807.	708.	626.	557.	498.	447.

STOR

6.	6.	6.	6.	6.	6.	8.	11.	17.	24.
33.	43.	54.	65.	76.	86.	97.	110.	125.	149.
184.	228.	277.	330.	385.	442.	503.	566.	628.	685.
735.	779.	816.	847.	870.	886.	894.	897.	892.	882.
867.	846.	821.	792.	759.	721.	679.	633.	583.	529.
473.	413.	356.	308.	269.	236.	209.	186.	166.	149.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	751.	45047.
CMS	34.	34.	34.	21.	1276.
INCHES		.14	.56	.87	.87
MM		3.54	14.14	22.12	22.12
AC-FT		595.	2381.	3725.	3725.
THOUS CU M		734.	2937.	4594.	4594.

MAXIMUM STORAGE = 897.

STATION 305, PLAN 2, RTIO 3

OUTFLOW

28.	28.	28.	28.	29.	32.	39.	55.	83.	121.
165.	213.	260.	308.	356.	405.	457.	517.	596.	713.
880.	1090.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

9.	9.	9.	9.	10.	11.	13.	18.	28.	40.
55.	71.	87.	103.	119.	135.	152.	172.	199.	238.
293.	363.	448.	557.	692.	845.	1006.	1171.	1332.	1484.
1625.	1515.	1392.	1495.	1585.	1424.	1489.	1543.	1350.	1385.
1413.	1432.	1445.	1451.	1450.	1445.	1434.	1419.	1400.	1376.
1547.	1313.	1277.	1237.	1196.	1151.	1105.	1057.	1007.	955.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	2885.	2885.	0.	0.	2885.	0.	0.	2885.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	867.	52032.
CMS	34.	34.	34.	25.	1473.
INCHES		.14	.56	1.01	1.01
MM		3.54	14.14	25.55	25.55
AC-FT		595.	2381.	4302.	4302.
THOUS CU M		734.	2937.	5307.	5307.

MAXIMUM STORAGE = 1625.

STATION 305, PLAN 2, RTIO 4

OUTFLOW

39.	39.	39.	40.	41.	45.	55.	77.	116.	168.
226.	286.	348.	413.	480.	548.	620.	700.	806.	967.
1194.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

13.	13.	13.	13.	14.	15.	18.	26.	39.	56.
75.	95.	116.	138.	160.	183.	207.	233.	269.	322.
393.	509.	660.	850.	1081.	1342.	1620.	1662.	1693.	1705.
1692.	1655.	1596.	1517.	1422.	1548.	1419.	1514.	1356.	1425.
1484.	1533.	1336.	1369.	1395.	1415.	1430.	1459.	1445.	1486.
1443.	1436.	1423.	1407.	1387.	1364.	1338.	1310.	1279.	1247.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	0.	2885.	0.	2885.	0.
0.	0.	2885.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	901.	54053.
CMS	34.	34.	34.	26.	1531.
INCHES		.14	.56	1.04	1.04
MM		3.54	14.14	26.54	26.54
AC-FT		595.	2381.	4469.	4469.
THOUS CU M		734.	2937.	5513.	5513.

MAXIMUM STORAGE = 1705.

STATION 305, PLAN 2, RTIO 5

OUTFLOW

56.	56.	56.	57.	59.	64.	78.	110.	165.	234.
309.	391.	478.	570.	662.	755.	853.	965.	1114.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

19.	19.	19.	19.	20.	21.	26.	37.	55.	78.
103.	130.	159.	190.	221.	252.	284.	322.	371.	453.
589.	787.	1049.	1381.	1774.	1964.	2171.	2375.	2560.	2714.
2831.	2911.	2956.	2967.	2946.	2897.	2827.	2736.	2631.	2508.
2370.	2219.	2058.	1886.	1706.	1518.	1323.	1360.	1391.	1418.
1440.	1457.	1471.	1480.	1485.	1486.	1485.	1480.	1473.	1465.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	937.	56234.
CMS	34.	34.	34.	27.	1592.
INCHES		.14	.56	1.09	1.09
MM		3.54	14.14	27.61	27.61
AC-FT		595.	2381.	4650.	4650.
THOUS CU M		734.	2937.	5736.	5736.

MAXIMUM STORAGE = 2967.

STATION 305, PLAN 2, RTIO 6

OUTFLOW

84.	84.	84.	85.	88.	96.	117.	165.	242.	337.
445.	565.	692.	822.	953.	1087.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

28.	28.	28.	28.	29.	32.	39.	55.	81.	112.
148.	188.	231.	274.	318.	362.	411.	474.	572.	734.
988.	1351.	1819.	2146.	2553.	3012.	3494.	3967.	4402.	4784.
5107.	5373.	5585.	5744.	5853.	5916.	5936.	5921.	5879.	5816.
5734.	5634.	5519.	5391.	5252.	5103.	4946.	4782.	4611.	4434.
4252.	4065.	3874.	3680.	3482.	3280.	3075.	2865.	2653.	2438.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	979.	58746.
CMS	34.	34.	34.	28.	1664.
INCHES		.14	.56	1.14	1.14
MM		3.54	14.14	28.85	28.85
AC-FT		595.	2381.	4858.	4858.
THOUS CU M		734.	2937.	5992.	5992.

MAXIMUM STORAGE = 5936.

STATION 305, PLAN 2, RTIO 7

OUTFLOW

123.	123.	124.	125.	130.	141.	172.	238.	343.	476.
632.	801.	978.	1161.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

41.	41.	41.	42.	43.	47.	57.	79.	114.	159.
211.	267.	326.	387.	455.	539.	644.	778.	964.	1252.
1689.	2049.	2559.	3221.	4011.	4873.	5754.	6610.	7401.	8102.
8705.	9217.	9654.	10030.	10353.	10620.	10833.	10991.	11096.	11154.
11173.	11160.	11120.	11057.	10976.	10880.	10772.	10653.	10524.	10387.
10242.	10090.	9933.	9770.	9603.	9432.	9256.	9076.	8895.	8708.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1013.	60766.
CMS	34.	34.	34.	29.	1721.
INCHES		.14	.56	1.17	1.17
MM		3.54	14.14	29.84	29.84
AC-FT		595.	2381.	5025.	5025.
THOUS CU M		734.	2937.	6198.	6198.

MAXIMUM STORAGE = 11173.

STATION 305, PLAN 2, RTIO 8

OUTFLOW

182.	182.	182.	185.	191.	209.	252.	345.	493.	683.
908.	1143.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

61.	61.	61.	62.	64.	70.	84.	115.	164.	228.
301.	381.	474.	591.	732.	898.	1097.	1343.	1677.	1929.
2398.	3115.	4074.	5246.	6586.	8026.	9516.	11027.	12526.	13968.
15323.	16582.	17737.	18776.	19689.	20484.	21167.	21741.	22215.	22597.
22893.	23112.	23266.	23362.	23406.	23406.	23372.	23312.	23230.	23130.
23016.	22891.	22758.	22617.	22469.	22315.	22156.	21992.	21823.	21651.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1043.	62551.
CMS	34.	34.	34.	30.	1771.
INCHES		.14	.56	1.21	1.21
MM		3.54	14.14	30.71	30.71
AC-FT		595.	2381.	5172.	5172.
THOUS CU M		734.	2937.	6380.	6380.

MAXIMUM STORAGE = 23406.

STATION 305 PLAN 2, RTIO 9

VPHP=1934621.
VOLP=1905040.

PUMPING	CAP COST	PWR COST	TOT ANN $
2865.3	3119.	102.	330.

OUTFLOW

246.	246.	247.	250.	259.	283.	338.	457.	653.	908.
1195.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

82.	82.	82.	83.	86.	94.	113.	152.	218.	301.
396.	518.	674.	864.	1091.	1360.	1676.	1816.	2071.	2534.
3307.	4027.	5857.	7573.	9549.	11739.	14086.	16526.	18985.	21377.
23037.	25730.	27641.	29357.	30670.	32183.	33307.	34262.	35065.	35725.
36750.	36671.	36989.	37228.	37399.	37507.	37561.	37569.	37541.	37485.
37406.	37309.	37197.	37073.	36941.	36802.	36655.	36503.	36346.	36184.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.
2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.	2885.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1065.	63876.
CMS	34.	34.	34.	30.	1809.
INCHES		.14	.56	1.23	1.23
MM		3.54	14.14	31.37	31.37
AC-FT		595.	2381.	5282.	5282.
THOUS CU M		734.	2937.	6515.	6515.

MAXIMUM STORAGE = 37569.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IAQST	ADSCNT	AANCST	ILPR
305	10	2	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 305 PLAN 1

FREQ	STOR	SUM	TYPE 1	TYPE 2
.700	1500.	0.000	0.000	0.000
.600	2300.	48.000	37.500	10.500
.450	4000.	90.000	75.000	15.000
.250	7000.	1177.500	1125.000	52.500
.130	12500.	3255.000	3150.000	105.000
.050	20000.	6052.500	5850.000	202.500
.020	28000.	7350.000	7050.000	300.000
.010	37000.	9390.000	9000.000	390.000
.005	50000.	11190.000	10650.000	540.000
.002	76000.	11835.000	11250.000	585.000

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 305 PLAN 1

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1486.	.700	.152	2.02	1.58	.44
3	3587.	.480	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15876.	.075	.075	311.36	300.95	10.41
7	24937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40

FLOOD DAMAGES FOR STATION 305 PLAN 2

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	607.	.700	0.000	0.00	0.00	0.00
2	697.	.700	.152	0.00	0.00	0.00
3	1625.	.480	.197	.87	.68	.19
4	1705.	.311	.150	2.88	2.21	.63
5	2967.	.169	.119	8.50	7.10	1.41
6	5936.	.075	.075	60.25	57.40	2.86
7	11173.	.030	.037	102.59	99.08	3.50
8	23406.	.009	.013	76.52	73.65	2.89
9	37569.	.004	.008	64.30	61.59	2.71
		AVG ANN DMG		315.88	301.70	14.19
		AVG ANN BFT		794.33	763.12	31.21

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .25	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 1.00	RATIO 6 1.50	RATIO 7 2.20	RATIO 8 3.25	RATIO 9 4.40
				RATIOS APPLIED TO FLOWS								
HYDROGRAPH AT	10	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	110	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	590.	661.	940.	1095.	1340.	1599.	3113.	8608.	14282.
			(	16.72)(	18.73)(	26.61)(	31.01)(	37.96)(	45.29)(	88.15)(	243.74)(	404.42)
ROUTED TO	1030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	529.	593.	853.	1018.	1260.	1535.	2601.	7263.	12276.
			(	14.98)(	16.80)(	24.15)(	28.84)(	35.67)(	43.47)(	73.67)(	205.67)(	347.63)
HYDROGRAPH AT	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	2030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
			(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
HYDROGRAPH AT	30	10.00	1	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
	(	25.90)	(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
			2	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
			(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
3 COMBINED	30	80.20	1	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
	(	207.72)	(	62.84)(	75.79)(	129.21)(	194.23)(	287.53)(	444.39)(	672.47)(	1000.86)(	1359.53)
			2	1664.	1968.	3196.	4616.	6625.	9960.	14769.	22446.	34011.
			(	47.13)(	55.74)(	90.51)(	130.72)(	187.60)(	282.04)(	418.21)(	635.59)(	963.08)
ROUTED TO	305	80.20	1	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
	(	207.72)	(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			2	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
			(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			PEAK STORAGES IN ACRE FEET (1000 CUBIC METERS)									
			1	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
			(	1278.)(	1833.)(	4424.)(	7283.)(	11788.)(	19583.)(	30760.)(	47734.)(	66455.)
			2	607.	897.	1625.	1705.	2967.	5936.	11173.	23406.	37569.
			(	749.)(	1106.)(	2004.)(	2103.)(	3660.)(	7322.)(	13782.)(	28871.)(	46341.)

SYSTEM OPTIMIZATION RESULTS

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	DIV 7	DIV 8	PMP 9	PMP 10
9119.	0.	0.	0.	0.	0.	0.	0.	2885.	0.

SYSTEM COST AND PERFORMANCE SUMMARY
(UNITS SAME AS INPUT - NORMALLY 1000'S OF DOLLARS)

TOTAL SYSTEM CAPITAL COST * * * * * * * * * * * * * *	7497.	
TOTAL SYSTEM AMORTIZED CAPITAL COST * * * * * * * * *	378.	
TOTAL SYSTEM ANNUAL O,M,POWER AND REPLACEMENT COST *	274.	
TOTAL SYSTEM ANNUAL COST * * * * * * * * * * * * * *		652.
AVERAGE ANNUAL DAMAGES -- EXISTING CONDITIONS * * * *	1177.	
AVERAGE ANNUAL DAMAGES -- OPTIMIZED SYSTEM * * * * *	353.	
AVERAGE ANNUAL DAMAGE REDUCTION (BENEFITS) * * * * *		824.
AVERAGE ANNUAL SYSTEM NET BENEFITS * * * * * * * * *		173.

***** OPTIMIZATION OBJECTIVE - MAXIMIZE SYSTEM NET BENEFITS *****

TFCST	ANFCST	ANOMPR	TANCST	ANDGBS	ANDMG	TBNFTS	NTBNFT
8740.	440.	301.	742.	1177.	277.	900.	158.

EXHIBIT 4

SIZING RESERVOIR AND PUMPING PLANT

(Hydrologic Performance Constrained)

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A         FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
R-A       SIZING RESERVOIR AND PUMPING PLANT
R-A       HYDROLOGIC PERFORMANCE CONSTRAINED
9        60        1                                                          3
R-1       7
J         2        0        1
1      0.25     0.30     0.50     0.70     1.00     1.50     2.20     3.25     4.40
R-2   -5000                                                                -5000
N-3
6
K         0       10                                                 1
1         POTENTIAL RESERVOIR INFLOW
M        -1               35.1                                                         1
N        24       24        26       33       50       85      190      375      515      590
N       660      710       760      800      840      910     1040     1290     1920     3000
N      3950     4600      5080     5360     5370     5100     4600     3980     3330     2720
N      2200     1840      1540     1250      995      775      605      470      365      280
N       215      160       120       95       77       66       59       53       49       42
N        40       38        35       33       30       30       29       27       25       25
K         1      110                                   2        1
1         PROPOSED RESERVOIR
Y                                  -1        0
Y                                   1        0        1
1         1                                                  -1
5     25000        0       200    975.0       .5    100.0     .025    .0504
1         0     2500      4000     5200     6800     9000    11500    15500    21000    30000
2       965     1000      1015     1030     1045     1060     1075     1090     1105     1120
3         0     1500      2400     3000     3600     4350     4950     5550     6000     7200
K         1     1030         1                                   1
1         POTENTIAL CHANNEL MODIFICATION REACH
Y                                   1        1                                    0
1         1                                                  -1
2         0       50       475      940     2135     3080     6300
3         0      200      1020     2050     6100    10250    24000
R-Z    1030       16         3        1     1200        1
1         6      5.5       4.5      3.5      2.5      1.5       .9       .7       .5      .35
1       .25      .15       .10      .05      .02     .005
2      1030     1130      1380     1740     2280     3200     4220     4800     5620     6480
2      7340     8540     10000    12100    15100    21000
3
4         0        0        .1       .2       .3       .3       .4       .5       .6       .7
4        .8       .9       1.0      1.2      1.5      1.8
4         0        0        .5       .7      1.5      2.2      2.9      3.5      4.0      4.7
4       5.8      6.6       8.0     10.3     15.0     18.1
4         0        0       1.0      1.5      3.2      4.7      6.5      7.8      9.3     11.0
4      13.7     15.6      19.0     23.0     27.8     30.2
K         0       20
M        -1               35.1                                                         1
N        24       24        26       33       50       85      190      375      515      590
N       660      710       760      800      840      910     1040     1290     1920     3000
N      3950     4600      5080     5360     5370     5100     4600     3980     3330     2720
N      2200     1840      1540     1250      995      775      605      470      365      280
N       215      160       120       95       77       66       59       53       49       42
N        40       38        35       33       30       30       29       27       25       25
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( )= REVISED INPUT DATA

Exhibit 4
1 of 28

```
K     1   2030     1                                 1
1      POTENTIAL LEVEE AND/OR BYPASS REACH
V                           1       1                                 0
1     1                                             -1
2     0     50     475     940    2135    3080    6300
3     0    200    1020    2050    6100   10250   24000
Z  2030     16       1       1
1     6    5.5     4.5     3.5     2.5     1.5      .9      .7      .5     .35
1   .25    .15     .10     .05     .02    .005
2  1030   1130    1380    1740    2280    3200    4220    4800    5620    6480
2  7340   8540   10000   12100   15100   21000
3
8     0      0     1.6     2.4     5.0     7.2     9.8    11.8    13.9    16.4
4  20.3   23.1    28.0    34.5    44.3    50.1
K     0     30                                       1
1      LOCAL INFLOW TO FOREBAY POOL
N    -1            10.0                                              1
N     8      8       9      11      17      28      63     125     173     195
N   220    230     255     265     280     305     350     430     640    1000
N  1320   1540    1650    1800    1810    1690    1530    1330    1110     900
N   730    615     515     415     330     255     200     155     120      93
N    72     54      41      32      26      22      20      18      16      14
N    13     12      11      11      11      10      10       9       9       9
K     3     30                                       1
1      COMBINED INFLOW TO FOREBAY POOL
K     1    305       1                       2       1
1      PROPOSED PUMPING PLANT SITE
V                           1       0                                 1
1     1                                             -1
2     0    400  100000
3     0   1200    1200
V                           1                        9                1
1     1                                             -1
2     0    400  100000
3     0   1200    1200
8 10000      0    1500     100    .023   .0504
1     0    250     500    1000    2000    6000    8000   10000
2     0    670    1000    1600    2300    6000    7860    8670
R- Z   305     10       2       1    5000     .05
1   .70    .60     .45     .25     .10     .05     .02     .01    .005    .002
2  1500   2300    4000    7000   12500   20000   28000   37000   50000   76000
3
8     0   37.5     75.    1125    3150    5850    7050    9000   10650   11250
4     0   10.5      15    52.5     105   202.5     300     390     540     585
K    99
A
A
A
A
A
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

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FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
SIZING RESERVOIR AND PUMPING PLANT
HYDROLOGIC PERFORMANCE CONSTRAINED

                    JOB SPECIFICATION
     NQ   NHR  NMIN  IDAY   IHR  IMIN METRC  IPLT  IPRT NSTAN
     60     1     0     0     0     0     0     0     5     0
                    JUPER   NHT LROPT TRACE
                        7     0     0     0

              MULTI=PLAN ANALYSES TO BE PERFORMED
                NPLAN= 2 NRTIO= 9 LRTIO= 1
RTIOS=    .25    .30    .50    .70   1.00   1.50   2.20   3.25   4.40

                              SYSTEM OPTIMIZATION
  VAR 1      VAR 2      VAR 3      VAR 4      VAR 5      VAR 6      DIV 7      DIV 8      PMP 9      PMP 10
 =5000.         0.         0.         0.         0.         0.         0.         0.     =5000.         0.
                                             ANORM       CNST
                                               .10       1.00

                    FIXED COST INPUT
                 FCAP     FDCNT       FAN
                   0.    0.0000    0.0000
                   0.        0.        0.

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
              1030        1224.953      1200.000            .002         24.953

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
               305        7762.425      5000.000         931.715       2762.425

          NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
           1   1  1  .500E+04  .500E+04   931.715   685.365   334.300  .951E+06

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
              1030        1225.118      1200.000            .002         25.118

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
               305        7815.023      5000.000        1004.728       2815.023

          NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
           2   1  1  .495E+04  .495E+04  1004.728   683.630   336.115  .103E+07

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
              1030        1225.233      1200.000            .002         25.233

              ISTA        INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
               305        7867.667      5000.000        1082.021       2867.667

          NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
           3   1  1  .490E+04  .490E+04  1082.021   681.895   337.930  .110E+07
OBJECTIVE FUNCTION FOR VARIABLE 1      .9511E+06      .1026E+07      .1104E+07
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                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1214.982      1200.000            .000         14.982

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       6997.027      5000.000         254.482       1997.027

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           1  9  1  .500E+04  .583E+04    254.482    708.257    307.809  .260E+06
VAR  1 ADJ FROM        5000.00 TO        5826.40

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1214.982      1200.000            .000         14.982

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       7061.828      5000.000         289.154       2061.828

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           2  9  1  .495E+04  .583E+04    289.154    704.862    309.993  .294E+06

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1214.982      1200.000            .000         14.982

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       7126.578      5000.000         327.224       2126.578

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           3  9  1  .490E+04  .583E+04    327.224    701.468    311.125  .332E+06

OBJECTIVE FUNCTION FOR VARIABLE 9      .2596E+06      .2945E+06      .3324E+06

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1214.982      1200.000            .000         14.982

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       6307.512      5000.000          46.763       1307.512

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           1  1  9  .583E+04  .555E+04     46.763    745.838    285.003  .492E+05
VAR  9 ADJ FROM        5000.00 TO        5553.52

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1215.496      1200.000            .000         15.496

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       6349.331      5000.000          53.039       1349.331

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           2  1  9  .577E+04  .555E+04     53.039    744.358    286.520  .557E+05

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                1030       1216.060      1200.000            .000         16.060

                                                                ISTA       INT FLOW      TRG FLOW         FLW OBJ        FLW DEV
                                                                 305       6391.365      5000.000          59.963       1391.365

                                                          NC  M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG D FTN(NC)
                                                           3  1  9  .571E+04  .555E+04     59.963    742.870    288.041  .628E+05

OBJECTIVE FUNCTION FOR VARIABLE 1      .4924E+05      .5571E+05      .6285E+05
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                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,351     1200,000           ,000       12,351

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      6019,769     5000,000         17,303     1019,769

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  9  1  ,555E+04  ,636E+04   17,303   759,453   272,327  ,189E+05
VAR  1 ADJ FROM       5826,40 TO       6360,80

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,351     1200,000           ,000       12,351

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      6083,313     5000,000         22,036     1083,313

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  9  1  ,550E+04  ,636E+04   22,036   755,682   274,393  ,237E+05

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,351     1200,000           ,000       12,351

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      6146,839     5000,000         27,678     1146,839

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  9  1  ,548E+04  ,636E+04   27,678   751,912   276,459  ,295E+05

OBJECTIVE FUNCTION FOR VARIABLE 9      ,1889E+05      ,2373E+05      ,2949E+05

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,351     1200,000           ,000       12,351

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      5731,269     5000,000          4,576      731,269

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  1  9  ,636E+04  ,582E+04    4,576   777,459   262,641  ,580E+04
VAR  9 ADJ FROM       5553,52 TO       5818,71

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,488     1200,000           ,000       12,488

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      5756,224     5000,000          5,233      756,224

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  1  9  ,630E+04  ,582E+04    5,233   775,838   264,030  ,648E+04

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                        1030      1212,670     1200,000           ,000       12,670

                                                        ISTA      INT FLOW     TRG FLOW        FLW OBJ      FLW DEV
                                                         305      5782,138     5000,000          5,988      782,138

                                                     NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  1  9  ,623E+04  ,582E+04    5,988   774,217   265,834  ,726E+04

OBJECTIVE FUNCTION FOR VARIABLE 1      ,5799E+04      ,6481E+04      ,7265E+04
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                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212.494     1200,000           ,000        12,494

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5587.516     5000,000          1,906       587,516

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               1  9  1  ,582E+04  ,676E+04     1,906    787,613   254,297  ,383E+04
VAR  1 ADJ FROM        6360,80 TO        6757,05

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212.494     1200,000           ,000        12,494

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5650.189     5000,000          2,860       650,189

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               2  9  1  ,576E+04  ,676E+04     2,860    783,663   256,439  ,401E+04

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212.494     1200,000           ,000        12,494

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5712.839     5000,000          4,131       712,839

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               3  9  1  ,570E+04  ,676E+04     4,131    779,712   258,607  ,533E+04
OBJECTIVE FUNCTION FOR VARIABLE 9      ,3028E+04      ,4014E+04      ,5328E+04

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212.494     1200,000           ,000        12,494

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5430.135     5000,000           ,548       430,135

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               1  1  9  ,676E+04  ,596E+04      ,548    797,527   249,265  ,162E+04
VAR  9 ADJ FROM        5818,71 TO        5964,73

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212,365     1200,000           ,000        12,365

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5453,915     5000,000           ,679       453,915

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               2  1  9  ,669E+04  ,596E+04      ,679    795,780   250,624  ,176E+04

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                    1030      1212,268     1200,000           ,000        12,268

                                                                    ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                                     305      5477,721     5000,000           ,833       477,721

                                                              NC  M M1     VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                               3  1  9  ,662E+04  ,596E+04      ,833    794,039   251,997  ,192E+04
OBJECTIVE FUNCTION FOR VARIABLE 1      ,1620E+04      ,1757E+04      ,1918E+04
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                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1213,339      1200,000           ,000        13,339

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5315,366      5000,000           ,158       315,366

                                                   NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                   1  9  1  ,596E+04  ,712E+04       ,158   806,069   242,842  ,122E+04
VAR  1 ADJ FROM        6757,05 TO        7116,73

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1213,339      1200,000           ,000        13,339

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5379,462      5000,000           ,332       379,462

                                                   NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                   2  9  1  ,591E+04  ,712E+04       ,332   801,999   245,064  ,139E+04

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1213,339      1200,000           ,000        13,339

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5443,534      5000,000           ,619       443,534

                                                   NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                   3  9  1  ,585E+04  ,712E+04       ,619   797,949   247,286  ,169E+04
OBJECTIVE FUNCTION FOR VARIABLE 9      ,1215E+04      ,1395E+04      ,1693E+04

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1213,339      1200,000           ,000        13,339

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5250,302      5000,000           ,063       250,302

                                                   NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                   1  1  9  ,712E+04  ,603E+04       ,063   810,168   240,612  ,112E+04
VAR  9 ADJ FROM        5964,73 TO        6025,26

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1213,339      1200,000           ,000        13,339

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5250,302      5000,000           ,063       250,302

                                                   NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                   1  1  9  ,712E+04  ,603E+04       ,063   810,168   240,612  ,112E+04

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                        1030      1212,866      1200,000           ,000        12,866

                                                        ISTA      INT FLOW      TRG FLOW        FLW OBJ       FLW DEV
                                                         305      5272,249      5000,000           ,088       272,249
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AD-A106 702 HYDROLOGIC ENGINEERING CENTER DAVIS CA F/G 8/8

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY. R--ETC(U)

SEP 77

UNCLASSIFIED HEC-TD-9-REV NL

2 of 3

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                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                       2  1  9  .705E+04  .603E+04      .088    808,501   241,846  .114E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1212,424      1200,000              ,000         12,424

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5294,204      5000,000              ,120        294,204

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                       3  1  9  .697E+04  .603E+04      .120    806,935   243,082  .118E+04
OBJECTIVE FUNCTION FOR VARIABLE 1     .1117E+04     .1143E+04     .1176E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1214,815      1200,000              ,000         14,815

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5182,446      5000,000              ,018        182,446

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
VAR  1 ADJ FROM       7116,73 TO       7336,88         1  9  1  .603E+04  .734E+04      .018    815,324   236,794  .107E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1214,815      1200,000              ,000         14,815

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5182,446      5000,000              ,018        182,446

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                       1  9  1  .603E+04  .734E+04      .018    815,324   236,794  .107E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1214,815      1200,000              ,000         14,815

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5247,090      5000,000              ,060        247,090

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                       2  9  1  .597E+04  .734E+04      .060    811,224   239,021  .111E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1214,815      1200,000              ,000         14,815

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5311,713      5000,000              ,151        311,713

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                       3  9  1  .590E+04  .734E+04      .151    807,133   241,265  .121E+04
OBJECTIVE FUNCTION FOR VARIABLE 9     .1071E+04     .1113E+04     .1207E+04

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                         1030        1214,815      1200,000              ,000         14,815

                                                         ISTA        INT FLOW      TRG FLOW           FLW OBJ        FLW DEV
                                                          305        5162,435      5000,000              ,011        162,435

                                                      NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST     ANDMG O FTN(NC)
VAR  9 ADJ FROM       6025,26 TO       6040,14         1  1  9  .734E+04  .604E+04      .011    810,613   236,138  .108E+04
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Exhibit 4

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                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1214,815     1200,000             ,000        14,815

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5162,435     5000,000             ,011       162,435

                                                NC  M M1     VAR(M)   VAR(M1)  OBJ DEV   TANCST     ANDMG Q FTN(NC)
                                                 1  1  9  ,734E+04  ,604E+04     ,011   816,613   236,138  ,106E+04

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1214,389     1200,000             ,000        14,389

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5184,776     5000,000             ,019       184,776

                                                NC  M M1     VAR(M)   VAR(M1)  OBJ DEV   TANCST     ANDMG Q FTN(NC)
                                                 2  1  9  ,726E+04  ,604E+04     ,019   814,895   237,413  ,107E+04

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1213,868     1200,000             ,000        13,868

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5207,377     5000,000             ,030       207,377

                                                NC  M M1     VAR(M)   VAR(M1)  OBJ DEV   TANCST     ANDMG Q FTN(NC)
                                                 3  1  9  ,719E+04  ,604E+04     ,030   813,176   238,682  ,108E+04
OBJECTIVE FUNCTION FOR VARIABLE 1      ,1065E+04      ,1072E+04      ,1083E+04

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1215,736     1200,000             ,000        15,736

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5128,678     5000,000             ,005       128,678

                                                NC  M M1     VAR(M)   VAR(M1)  OBJ DEV   TANCST     ANDMG Q FTN(NC)
VAR  1 ADJ FROM        7336,88 TO       7452,02  1  9  1  ,604E+04  ,745E+04     ,005   819,310   234,183  ,106E+04

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1215,736     1200,000             ,000        15,736

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5128,678     5000,000             ,005       128,678

                                                NC  M M1     VAR(M)   VAR(M1)  OBJ DEV   TANCST     ANDMG Q FTN(NC)
                                                 1  1  1  ,745E+04  ,745E+04     ,005   819,310   234,183  ,106E+04

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                   1030      1215,130     1200,000             ,000        15,130

                                                   ISTA      INT FLOW     TRG FLOW          FLW OBJ       FLW DEV
                                                    305      5150,515     5000,000             ,008       150,515
```

```
NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
 2  1  1   .738E+04  .738E+04     .008      817.564    235.847   .106E+08

       ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
       1030        1214.613        1200.000            .000           14.613

       ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
        305        5172.619        5000.000            .014          172.619

NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
 3  1  1   .730E+04  .730E+04     .016      815.819    236.723   .107E+08
```

```
OBJECTIVE FUNCTION FOR VARIABLE 1      .1058E+04      .1062E+04      .1068E+04
```

```
       ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
       1030        1216.320        1200.000            .000           16.320

       ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
        305        5100.498        5000.000            .002          100.498

NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
 1  9  1   .604E+04  .753E+04     .002      821.091    232.898   .106E+08
```

```
VAR  1 ADJ FROM       7452.02 TO       7528.06
```

**********   **********   **********   **********   **********

SUB-AREA RUNOFF COMPUTATION

POTENTIAL RESERVOIR INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10	0	0	2	0	0	1	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1,RATIO 1

6.	6.	7.	8.	13.	21.	48.	94.	129.	188.
165.	178.	190.	200.	210.	228.	260.	323.	480.	750.
987.	1150.	1270.	1340.	1345.	1275.	1150.	995.	833.	680.
550.	460.	385.	313.	249.	194.	151.	118.	91.	70.
54.	40.	30.	24.	19.	17.	15.	13.	12.	11.
10.	10.	9.	8.	8.	6.	7.	7.	6.	6.

**********   **********   **********   **********   **********

```
                                   HYDROGRAPH ROUTING

         PROPOSED RESERVOIR
                ISTAQ   ICOMP    IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  110       1        0       0       0       2       1       0       0

                                         PLAN 1
                                      ROUTING DATA
         QLOSS   CLOSS     AVG     IRES   ISAME    IOPT    IPMP    IDVR    LSTR
           0.0   0.000    0.00       -1       0       0       0       0       0

                                         PLAN 2
                                      ROUTING DATA
         QLOSS   CLOSS     AVG     IRES   ISAME    IOPT    IPMP    IDVR    LSTR
           0.0   0.000    0.00        1       0       1       0       0       0

                 NSTPS   NSTDL      LAG   AMSKK       X     TSK    STORA
                     1       0        0   0.000   0.000   0.000      -1.

                                      RESERVOIR DATA
    CAPMX   CAPMN    COQL   ELEVL    EXPL    COQW  WANCST  WDSCNT    COQT   ELEVT    EXPT
   25000.      0.  200.00  975.00     .50  100.00   .0255   .0504    0.00  975.00    0.00

   CAPACITY=      0.   2500.   4000.   5200.   6800.   9000.  11500.  15500.  21000.  30000.
  ELEVATION=    965.   1000.   1015.   1030.   1045.   1060.   1075.   1090.   1105.   1120.
       COST=      0.   1500.   2400.   3000.   3600.   4350.   4950.   5550.   6000.   7200.

 OUTLET CREST ELEVATION IS 1049.96 AT STORAGE OF     752P.

                              SYNTHETIC STORAGE OUTFLOW FUNCTION
   STORAGE=    714.   1049.   2053.   4173.   7528.  11320.  14905.  19092.  24199.  30000.
   OUTFLOW=      0.    433.    866.   1299.   1732.  13711.  25570.  37801.  49216.  61029.

                         STATION     110, PLAN 2, RTIO 1

                                       OUTFLOW
        6.       6.       6.       6.       7.       8.      10.      16.      26.      37.
       50.      62.      74.      86.      99.     111.     124.     141.     160.     213.
      280.     360.     437.     468.     498.     527.     551.     569.     581.     587.
      588.     585.     580.     571.     561.     549.     536.     522.     508.     493.
      477.     462.     447.     432.     391.     353.     319.     288.     260.     235.
      212.     191.     173.     156.     141.     128.     115.     104.      96.      85.

                                        STOR
      719.     719.     719.     719.     719.     720.     722.     727.     734.     743.
      753.     762.     772.     781.     790.     800.     810.     823.     844.     879.
      930.     992.    1059.    1130.    1201.    1267.    1322.    1365.    1393.    1407.
     1409.    1402.    1389.    1370.    1347.    1319.    1289.    1256.    1222.    1187.
     1152.    1117.    1083.    1049.    1016.     987.     961.     937.     915.     896.
      878.     862.     848.     835.     823.     813.     803.     795.     787.     780.

                           PEAK   6-HOUR  24-HOUR  72-HOUR   TOTAL VOLUME
                   CFS     588.     582.     512.     278.         16071.
                   CMS      17.      16.      14.       8.           472.
                INCHES               .15      .54      .74            .74
                    MM              3.92    13.78    18.70          18.70
                 AC-FT               289.    1016.    1378.          1378.
           THOUS CU M               356.    1253.    1700.          1700.

                               MAXIMUM STORAGE =     1409.
```

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STATION 110, PLAN 2, RTIO 9

RESERVOIR	CAP COST	TOT ANN $
7528.1	3848.	282.

OUTFLOW

106.	106.	106.	108.	116.	134.	182.	290.	442.	512.
590.	675.	764.	858.	908.	957.	1013.	1082.	1182.	1327.
1475.	1659.	4684.	8907.	12302.	14608.	16357.	16954.	16747.	15932.
14722.	13348.	11983.	10633.	9318.	8065.	6904.	5850.	4927.	4117.
3418.	2819.	2310.	1886.	1725.	1708.	1693.	1677.	1662.	1646.
1631.	1615.	1600.	1584.	1569.	1554.	1539.	1524.	1509.	1494.

STOR

796.	796.	796.	798.	804.	818.	855.	938.	1070.	1231.
1413.	1610.	1818.	2034.	2260.	2501.	2774.	3111.	3601.	4392.
5540.	6965.	8465.	9799.	10874.	11657.	12133.	12310.	12253.	12003.
11030.	11205.	10773.	10346.	9929.	9535.	9165.	8833.	8540.	8283.
8062.	7872.	7711.	7577.	7459.	7343.	7220.	7107.	6987.	6867.
6747.	6627.	6507.	6388.	6269.	6151.	6034.	5917.	5801.	5696.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16954.	15920.	8768.	4122.	247316.
CMS	480.	451.	248.	117.	7003.
INCHES		4.22	9.29	10.92	10.92
MM		107.17	236.09	277.47	277.47
AC-FT		7898.	17400.	20450.	20450.
THOUS CU M		9742.	21462.	25225.	25225.

MAXIMUM STORAGE = 12310.

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HYDROGRAPH ROUTING

POTENTIAL CHANNEL MODIFICATION REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6380.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 1030, PLAN 1, RTIO 1

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EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IADST	ADSCNT	AANCS1	IIPR
1030	16	3	1	1200.	1.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1130.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4800.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	6480.	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8540.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15130.	44.300	1.500	15.000	27.800
.005	21000.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.98	.07	.30	.61
3	1940.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.49
8	15177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97

FLOOD DAMAGES FOR STATION 1030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	526.	6.000	.284	0.00	0.00	0.00	0.00
2	593.	5.462	1.752	0.00	0.00	0.00	0.00
3	887.	3.097	1.776	0.00	0.00	0.00	0.00
4	1008.	1.769	1.072	0.00	0.00	0.00	0.00
5	1257.	.867	.785	.62	.04	.19	.38
6	1548.	.323	.391	1.12	.07	.34	.71
7	4177.	.095	.136	1.37	.06	.40	.91
8	9277.	.020	.037	.90	.03	.26	.61
9	14506.	.006	.014	.54	.02	.17	.35
		AVG ANN DMG		4.54	.22	1.37	2.96
		AVG ANN BFT		29.03	1.37	8.65	19.01

EXCEEDENCE FREQUENCY = 1.000 TARGET FLOW/STON = 1200. REGULATED FLOW/STON = 1216.

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
20	0	0	2	0	0	0	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1, RATIO 1

6.	6.	7.	8.	13.	21.	48.	94.	129.	148.
165.	178.	190.	200.	210.	228.	260.	323.	480.	750.
987.	1150.	1270.	1340.	1343.	1275.	1150.	995.	855.	680.
550.	460.	385.	313.	249.	194.	151.	118.	91.	70.
54.	40.	30.	26.	19.	17.	15.	13.	12.	11.
10.	10.	9.	8.	8.	8.	7.	7.	6.	6.

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HYDROGRAPH ROUTING

POTENTIAL LEVEE AND/OR BYPASS REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6300.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 2030, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	209.	17369.
CMS	27.	26.	17.	6.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

MAXIMUM STORAGE = 434.

STATION 2030, PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

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EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPHT	IAGST	ADSCNT	AANCST	ILPR
2030	16	1	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.600	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6480.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1940.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1940.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58
		AVG ANN BFT		.00	0.00

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SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	0	0	2	0	0	1	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1,RATIO 1

2.	2.	2.	3.	4.	7.	16.	31.	43.	49.
55.	58.	64.	66.	70.	76.	88.	106.	160.	250.
330.	385.	413.	450.	455.	423.	383.	333.	278.	225.
183.	154.	129.	104.	83.	64.	50.	39.	30.	23.
18.	14.	10.	8.	7.	6.	5.	5.	4.	4.
3.	3.	3.	3.	3.	3.	3.	2.	2.	2.

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COMBINE HYDROGRAPHS

COMBINED INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	1	0	0	0	0	1	0	0

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2219.	2137.	1433.	675.	40523.
CMS	63.	61.	41.	19.	1147.
INCHES		.25	.66	.78	.78
MM		6.30	16.89	19.90	19.90
AC-FT		1060.	2844.	3351.	3351.
THOUS CU M		1308.	3508.	4133.	4133.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2676.	2571.	1713.	810.	48626.
CMS	76.	73.	49.	23.	1377.
INCHES		.30	.79	.94	.94
MM		7.57	20.19	23.88	23.88
AC-FT		1275.	3400.	4021.	4021.
THOUS CU M		1573.	4194.	4960.	4960.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4563.	4375.	2851.	1351.	81034.
CMS	129.	124.	81.	38.	2295.
INCHES		.51	1.32	1.57	1.57
MM		12.89	33.60	39.79	39.79
AC-FT		2171.	5658.	6700.	6700.
THOUS CU M		2678.	6980.	8265.	8265.

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Exhibit 4
20 of 28

HYDROGRAPH ROUTING

PROPOSED PUMPING PLANT SITE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
305	1	1	0	0	2	1	0	0

PLAN 1
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	0	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

STATION 305, PLAN 1, RTIO 1

OUTFLOW

14.	14.	14.	14.	15.	17.	22.	33.	53.	81.
114.	150.	187.	225.	262.	298.	335.	374.	421.	492.
597.	735.	897.	1078.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1069.	855.
685.	546.	437.	350.	280.	225.	181.	147.	119.	97.

STOR

5.	5.	5.	5.	5.	6.	7.	11.	18.	27.
38.	50.	62.	75.	87.	99.	112.	125.	140.	164.
199.	245.	299.	359.	425.	499.	581.	665.	746.	821.
885.	939.	981.	1011.	1030.	1036.	1032.	1017.	992.	958.
916.	867.	811.	749.	681.	606.	525.	439.	356.	285.
228.	182.	146.	117.	93.	75.	60.	49.	40.	32.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	670.	40227.
CMS	34.	34.	34.	19.	1139.
INCHES		.14	.56	.78	.78
MM		3.54	14.14	19.75	19.75
AC-FT		595.	2391.	3326.	3326.
THOUS CU M		734.	2937.	4103.	4103.

MAXIMUM STORAGE = 1036.

Exhibit 4
21 of 28

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PLAN 2
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	9	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

PUMPING PLANT DATA

PMPMX	PMPMN	PMPON	PMRCST	PANCST	PDSCNT
10000.	0.	1500.	100.	.02300	.05040

CAPACITY=	0.	250.	500.	1000.	2000.	6000.	8000.	10000.	0.	0.
COST=	0.	670.	1000.	1600.	2300.	6000.	7860.	8670.	0.	0.

STATION 305, PLAN 2, RTIO 1

OUTFLOW

18.	18.	14.	14.	15.	16.	20.	28.	42.	60.
83.	108.	135.	162.	190.	219.	249.	282.	323.	384.
472.	583.	709.	845.	984.	1116.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1132.	1019.	919.	831.	753.	685.
624.	569.	521.	477.	437.	402.	369.	339.	311.	284.

STOR

5.	5.	5.	5.	5.	5.	7.	9.	14.	20.
28.	36.	45.	54.	63.	73.	83.	94.	108.	128.
157.	194.	236.	282.	328.	372.	412.	450.	487.	521.
549.	572.	590.	602.	608.	608.	601.	590.	572.	550.
523.	492.	457.	418.	377.	340.	306.	277.	251.	228.
208.	190.	174.	159.	146.	134.	123.	113.	104.	95.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1151.	639.	38355.
CMS	34.	34.	33.	18.	1086.
INCHES		.14	.53	.74	.74
MM		3.54	13.56	18.83	18.83
AC-FT		595.	2284.	3171.	3171.
THOUS CU M		734.	2817.	3912.	3912.

MAXIMUM STORAGE = 608.

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STATION 305, PLAN 2, RTIO 9

VPMP=1991223.
VOLP=2091197.

PUMPING	CAP COST	PWR COST	TOT ANN $
6044.1	6041.	95.	539.

OUTFLOW

246.	246.	247.	250.	259.	283.	338.	458.	654.	905.
1196.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

82.	82.	82.	83.	86.	94.	113.	153.	218.	302.
399.	519.	674.	864.	1091.	1361.	1677.	1557.	1549.	1750.
2261.	3120.	4299.	5801.	7640.	9769.	12119.	14596.	17079.	19469.
21694.	23718.	25522.	27096.	28435.	29542.	30432.	31129.	31652.	32016.
32242.	32348.	32355.	32277.	32129.	31922.	31668.	31377.	31056.	30711.
30348.	29971.	29583.	29185.	28779.	28365.	27944.	27518.	27086.	26649.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	6044.	6044.	6044.
6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.
6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.
6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.
6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.	6044.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1065.	63883.
CMS	34.	34.	34.	30.	1809.
INCHES		.14	.56	1.23	1.23
MM		3.54	14.14	31.37	31.37
AC-FT		595.	2381.	5282.	5282.
THOUS CU M		734.	2937.	6516.	6516.

MAXIMUM STORAGE = 32355.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IABST	ADSCNT	AANCST	ILPR
305	10	2	1	5000.	.050	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 305 PLAN 1

FREQ	STOR	SUM	TYPE 1	TYPE 2
.700	1500.	0.000	0.000	0.000
.600	2300.	48.000	37.500	10.500
.450	4000.	90.000	75.000	15.000
.250	7000.	1177.500	1125.000	52.500
.100	12500.	3255.000	3150.000	105.000
.050	20000.	6052.500	5850.000	202.500
.020	28000.	7350.000	7050.000	300.000
.010	37000.	9390.000	9000.000	390.000
.005	50000.	11190.000	10650.000	540.000
.002	76000.	11835.000	11250.000	585.000

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 305 PLAN 1

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1486.	.700	.152	2.02	1.58	.44
3	3587.	.460	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15676.	.075	.075	311.36	300.95	10.41
7	24937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40

FLOOD DAMAGES FOR STATION 305 PLAN 2

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	608.	.700	0.000	0.00	0.00	0.00
2	898.	.700	.152	0.00	0.00	0.00
3	1628.	.460	.197	.85	.66	.19
4	1672.	.311	.150	1.44	1.12	.32
5	1775.	.169	.119	2.65	2.06	.58
6	3021.	.075	.075	9.80	8.75	1.06
7	7774.	.030	.037	59.38	57.12	2.26
8	19064.	.009	.013	64.27	62.01	2.26
9	32355.	.004	.008	56.38	54.05	2.34
		AVG ANN DMG		194.78	185.77	9.01
		AVG ANN BFT		915.43	879.04	36.39

EXCEEDENCE FREQUENCY = .050 TARGET FLOW/STOR = 5000. REGULATED FLOW/STOR = 5186.

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 1.00	RATIO 6 1.50	RATIO 7 2.20	RATIO 8 3.25	RATIO 9 4.40
HYDROGRAPH AT	10	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17455.	23628.
		(90.91)		(38.02)	(45.62)	(76.03)	(106.44)	(152.06)	(228.09)	(334.54)	(494.20)	(669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17455.	23628.
				(38.02)	(45.62)	(76.03)	(106.44)	(152.06)	(228.09)	(334.54)	(494.20)	(669.07)
ROUTED TO	110	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
		(90.91)		(38.02)	(45.62)	(76.03)	(106.44)	(152.06)	(228.09)	(334.54)	(494.20)	(669.07)
			2	588.	663.	919.	1086.	1329.	1622.	5264.	11126.	16954.
				(16.66)	(18.78)	(26.03)	(30.74)	(37.63)	(45.93)	(149.06)	(315.06)	(480.08)
ROUTED TO	1030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
		(90.91)		(26.65)	(32.24)	(54.94)	(82.71)	(122.10)	(189.70)	(288.58)	(429.77)	(583.42)
			2	526.	593.	847.	1008.	1257.	1548.	4177.	9277.	14506.
				(14.90)	(16.80)	(23.99)	(28.54)	(35.58)	(43.83)	(118.27)	(262.70)	(410.77)
HYDROGRAPH AT	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
		(90.91)		(38.02)	(45.62)	(76.03)	(106.44)	(152.06)	(228.09)	(334.54)	(494.20)	(669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
				(38.02)	(45.62)	(76.03)	(106.44)	(152.06)	(228.09)	(334.54)	(494.20)	(669.07)
ROUTED TO	2030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
		(90.91)		(26.65)	(32.24)	(54.94)	(82.71)	(122.10)	(189.70)	(288.58)	(429.77)	(583.42)
			2	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
				(26.65)	(32.24)	(54.94)	(82.71)	(122.10)	(189.70)	(288.58)	(429.77)	(583.42)
HYDROGRAPH AT	30	10.00	1	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
		(25.90)		(12.81)	(15.38)	(25.63)	(35.88)	(51.25)	(76.88)	(112.76)	(166.57)	(225.52)
			2	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
				(12.81)	(15.38)	(25.63)	(35.88)	(51.25)	(76.88)	(112.76)	(166.57)	(225.52)
3 COMBINED	30	80.20	1	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
		(207.72)		(62.84)	(75.79)	(129.21)	(194.23)	(287.53)	(444.39)	(672.47)	(1000.86)	(1359.53)
			2	1664.	1968.	3201.	4613.	6620.	9953.	14768.	24899.	37599.
				(47.12)	(55.74)	(90.64)	(130.61)	(187.46)	(281.84)	(418.19)	(705.06)	(1064.69)
ROUTED TO	305	80.20	1	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
		(207.72)		(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)
			2	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
				(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)	(33.98)
			PEAK STORAGES IN ACRE FEET (1000 CUBIC METERS)									
			1	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
				(1278.)	(1833.)	(4424.)	(7283.)	(11788.)	(19583.)	(30760.)	(47734.)	(66455.)
			2	608.	898.	1628.	1672.	1775.	3021.	7774.	19064.	32355.
				(750.)	(1108.)	(2008.)	(2062.)	(2189.)	(3727.)	(9589.)	(23515.)	(39909.)

Exhibit 4
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SYSTEM OPTIMIZATION RESULTS

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	DIV 7	DIV 8	PMP 9	PMP 10
7528.	0.	0.	0.	0.	0.	0.	0.	6044.	0.

SYSTEM COST AND PERFORMANCE SUMMARY
(UNITS SAME AS INPUT - NORMALLY 1000'S OF DOLLARS)

TOTAL SYSTEM CAPITAL COST * * * * * * * * * * * * * * *	9869.	
TOTAL SYSTEM AMORTIZED CAPITAL COST * * * * * * * * *	498.	
TOTAL SYSTEM ANNUAL O,M,POWER AND REPLACEMENT COST *	323.	
TOTAL SYSTEM ANNUAL COST * * * * * * * * * * * * * *		821.
AVERAGE ANNUAL DAMAGES -- EXISTING CONDITIONS * * * *	1177.	
AVERAGE ANNUAL DAMAGES -- OPTIMIZED SYSTEM * * * * *	233.	
AVERAGE ANNUAL DAMAGE REDUCTION (BENEFITS) * * * * *		944.
AVERAGE ANNUAL SYSTEM NET BENEFITS * * * * * * * * *		123.

***** OPTIMIZATION OBJECTIVE = MAXIMIZE SYSTEM NET BENEFITS FOR TARGET PROTECTION LEVEL *****

TFCST	ANFCST	ANOMPR	TANCST	ANDGBS	ANDMG	TBNFTS	NTBNFT
7975.	402.	283.	685.	1177.	334.	843.	158.

EXHIBIT 5

SIZING RESERVOIR, PUMPING PLANT AND DIVERSION

(Unconstrained)

A	FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION									
R-A	SIZING RESERVOIR, PUMPING PLANT AND DIVERSION									
R-A	UNCONSTRAINED									
B	60	1							1	
R-1	(6)									
J	2	9	1							
I	0.25	0.30	0.50	0.70	1.00	1.50	2.20	3.25	4.40	
R-2	-8000						-500		-1000	
8										
K	0	10					1			
1	POTENTIAL RESERVOIR INFLOW									
M	-1		35.1						1	
N	24	24	26	33	50	85	190	375	515	590
N	660	710	760	800	840	910	1040	1290	1920	3000
N	3950	4600	5080	5360	5370	5100	4600	3980	3330	2720
N	2200	1640	1540	1250	995	775	605	470	365	280
N	215	140	120	95	77	66	59	53	49	42
N	40	38	35	33	30	30	29	27	25	25
K	1	110				2	1			
1	PROPOSED RESERVOIR									
V				-1	0					
Y				1	0	1				
1	1						-1			
S	25000	0	200	975.0	.5	100.0	.023	.0504		
1	0	2500	4000	5200	6800	9000	11500	15500	21000	30000
2	965	1000	1015	1030	1045	1060	1075	1090	1105	1120
3	0	1500	2400	3000	3600	4350	4950	5550	6000	7200
K	1	1030	1				1			
1	POTENTIAL CHANNEL MODIFICATION REACH									
Y				1	1				0	
1	1						-1			
2	0	50	475	940	2135	3080	6300			
3	0	200	1020	2050	6100	10250	24000			
Z	1030	16	3	1						
1	6	5.5	4.5	3.5	2.5	1.5	.9	.7	.5	.35
1	.25	.15	.10	.05	.02	.005				
2	1030	1130	1380	1740	2280	3200	4220	4800	5620	6480
2	7340	8540	10000	12100	15100	21000				
3										
4	0	0	.1	.2	.3	.3	.4	.5	.6	.7
4	.8	.9	1.0	1.2	1.5	1.8				
4	0	0	.5	.7	1.5	2.2	2.9	3.5	4.0	4.7
4	5.8	6.6	8.0	10.3	15.0	18.1				
4	0	0	1.0	1.5	3.2	4.7	6.5	7.8	9.3	11.0
4	13.7	15.6	19.0	23.0	27.8	30.2				
K	0	20								
M	-1		35.1						1	
N	24	24	26	33	50	85	190	375	515	590
N	660	710	760	800	840	910	1040	1290	1920	3000
N	3950	4600	5080	5360	5370	5100	4600	3980	3330	2720
N	2200	1840	1540	1250	995	775	605	470	365	280
N	215	160	120	95	77	66	59	53	49	42
N	40	38	35	33	30	30	29	27	25	25
N-K	1	20				2	1			

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

○ = REVISED INPUT DATA

```
N-1        DUMMY RESERVOIR TO ACCOMODATE DIVERSION
    Y                                 -1       0
    Y                                  1       0                       7
    1        1                                                -1
    2        0    2000
    3        0  100000
    4    20000       0    1500    .015   .0504
    1        0    1250    2500    3750    5000    7500   10000   15000   20000
N-2 2        0    1500    2600    3400    4200    5200    6100    7500    8300
    K        1    2030       1                                 1
    1      POTENTIAL LEVEE AND/OR BYPASS REACH
    Y                                  1       1                               0
    1        1                                                -1
    2        0      50     475     940    2135    3080    6300
    3        0     200    1020    2050    6100   10250   24000
    Z     2030      16       1       1
    1        6     5.5     4.5     3.5     2.5     1.5      .9      .7      .5     .35
    1      .25     .15     .10     .05     .02    .005
    2     1030    1130    1380    1740    2280    3200    4220    4800    5620    6480
    2     7340    8540   10000   12100   15100   21000
    3
    4        0       0     1.6     2.4     5.0     7.2     9.8    11.8    13.9    16.4
    4     20.3    23.1    28.0    34.5    44.3    50.1
    K        0      30                                         1
    1      LOCAL INFLOW TO FOREBAY POOL
    N       -1            10.0                                                 1
    N        8       8       9      11      17      28      63     125     170     195
    N      220     230     255     265     280     305     350     430     640    1000
    N     1320    1540    1650    1800    1810    1690    1530    1330    1110     900
    N      730     615     515     415     330     255     200     155     120      93
    N       72      54      41      32      26      22      20      18      16      14
    N       13      12      11      11      11      10      10       9       9       9
    K        3      30                                         1
    1      COMBINED INFLOW TO FOREBAY POOL
    K        1     305       1                         2       1
    1      PROPOSED PUMPING PLANT SITE
    Y                                  1       0                               1
    1        1                                                -1
    2        0     400  100000
    3        0    1200    1200
    Y                                  1       0               9               1
    1        1                                                -1
    2        0     400  100000
    3        0    1200    1200
    4    10000       0    1500     100    .023   .0504
    1        0     250     500    1000    2000    6000    8000   10000
    2        0     670    1000    1600    2300    6000    7860    8670
    Z      305      10       2       1
    1      .70     .60     .45     .25     .10     .05     .02     .01    .005    .002
    2     1500    2300    4000    7000   12500   20000   28000   37000   50000   76000
    3
    4        0    37.5     75.    1125    3150    5850    7050    9000   10650   11250
    4        0    10.5      15    52.5     105   202.5     300     390     540     585
    K       99
    A
    A
    A
    A
    A
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

○ = REVISED INPUT DATA

```
FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
SIZING RESERVOIR, PUMPING PLANT AND DIVERSION
UNCONSTRAINED

                            JOB SPECIFICATION
      NQ    NHR   NMIN  IDAY    IHR  IMIN METRC  IPLT  IPRT NSTAN
      60      1      0     0      0     0     0     0     3     0
                       JUPER    NWT LROPT TRACE
                           6      0     0     0

                   MULTI-PLAN ANALYSES TO BE PERFORMED
                       NPLAN= 2 NRTIO= 9 LRTIO= 1
 RTIOS=    .25    .30    .50    .70   1.00   1.50   2.20   3.25   4.40

                              SYSTEM OPTIMIZATION
   VAR 1     VAR 2     VAR 3     VAR 4     VAR 5     VAR 6     DIV 7     DIV 8     PMP 9    PMP 10
  -4000.        0.        0.        0.        0.        0.     -500.        0.    -1000.        0.

                              FIXED COST INPUT
                          FCAP      FDCNT       FAN
                            0.     0.0000    0.0000
                            0.         0.        0.
                                  NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                   1  1  1   .400E+04   .400E+04     0.000   432.840    631.578  .106E+04

                                  NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                   2  1  1   .396E+04   .396E+04     0.000   431.170    634.120  .107E+04

                                  NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                   3  1  1   .392E+04   .392E+04     0.000   429.500    636.695  .107E+04
OBJECTIVE FUNCTION FOR VARIABLE 1      .1064E+04      .1065E+04      .1066E+04
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Exhibit 5
3 of 34

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                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  7  1   .500E+03  .506E+04    0.000    469.391    582.004  .105E+04
VAR  1 ADJ FROM       4000.00 TO      5055.27
                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  7  1   .495E+03  .506E+04    0.000    469.027    582.496  .105E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  7  1   .490E+03  .506E+04    0.000    468.664    582.991  .105E+04

OBJECTIVE FUNCTION FOR VARIABLE 7      .1051E+04     .1052E+04      .1052E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  9  7   .100E+04  .750E+03    0.000    487.619    558.766  .105E+04
VAR  7 ADJ FROM        500.00 TO       750.00
                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  9  7   .990E+03  .750E+03    0.000    486.738    559.987  .105E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  9  7   .980E+03  .750E+03    0.000    485.857    561.207  .105E+04

OBJECTIVE FUNCTION FOR VARIABLE 9      .1046E+04     .1047E+04      .1047E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  1  9   .506E+04  .150E+04    0.000    513.309    505.468  .102E+04
VAR  9 ADJ FROM       1000.00 TO      1500.00
                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  1  9   .500E+04  .150E+04    0.000    511.556    507.597  .102E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  1  9   .495E+04  .150E+04    0.000    509.803    509.724  .102E+04

OBJECTIVE FUNCTION FOR VARIABLE 1      .1019E+04     .1019E+04      .1020E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      1  7  1   .750E+03  .758E+04    0.000    577.444    427.657  .101E+04
VAR  1 ADJ FROM       5055.27 TO      7582.91
                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      2  7  1   .743E+03  .758E+04    0.000    576.896    428.296  .101E+04

                                                     NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                      3  7  1   .735E+03  .758E+04    0.000    576.349    428.938  .101E+04

OBJECTIVE FUNCTION FOR VARIABLE 7      .1005E+04     .1005E+04      .1005E+04
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                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .150E+04  .113E+04     0,000    604,961    400,764  .101E+04

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .150E+04  .863E+03     0,000    585,680    418,435  .100E+04
VAR  7 ADJ FROM        750,00 TO         862,50

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  9  7  .149E+04  .863E+03     0,000    584,910    419,866  .100E+04

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  9  7  .147E+04  .863E+03     0,000    584,139    421,302  .101E+04

OBJECTIVE FUNCTION FOR VARIABLE 9       .1004E+04     .1005E+04      .1005E+04

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  1  9  .758E+04  .225E+04     0,000    628,344    357,691  .986E+03
VAR  9 ADJ FROM       1500,00 TO        2250,00

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  1  9  .751E+04  .225E+04     0,000    626,570    359,038  .986E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  1  9  .743E+04  .225E+04     0,000    624,795    360,389  .985E+03

OBJECTIVE FUNCTION FOR VARIABLE 1       .9860E+03     .9856E+03      .9852E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  7  1  .863E+03  .506E+04     0,000    564,209    432,969  .997E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  7  1  .863E+03  .682E+04     0,000    610,603    371,331  .982E+03
VAR  1 ADJ FROM       7582,91 TO        6824,62

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  7  1  .854E+03  .682E+04     0,000    609,970    371,968  .982E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  7  1  .845E+03  .682E+04     0,000    609,337    372,543  .982E+03

OBJECTIVE FUNCTION FOR VARIABLE 7       .9819E+03     .9819E+03      .9819E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .225E+04  .129E+04     0,000    641,426    346,298  .988E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .225E+04  .992E+03     0,000    620,095    364,320  .984E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .225E+04  .901E+03     0,000    613,850    369,048  .982E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .225E+04  .863E+03     0,000    610,603    371,331  .982E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  9  7  .223E+04  .863E+03     0,000    609,075    372,993  .982E+03

                                                          NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  9  7  .221E+04  .863E+03     0,000    607,547    374,569  .982E+03

OBJECTIVE FUNCTION FOR VARIABLE 9       .9819E+03     .9821E+03      .9821E+03
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                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  1  9  .682E+04  .338E+04      0.000    686.984    307.995  .995E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  1  9  .682E+04  .259E+04      0.000    633.517    350.327  .984E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  1  9  .682E+04  .235E+04      0.000    617.477    364.816  .982E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  1  9  .682E+04  .225E+04      0.000    610.603    371.331  .982E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     2  1  9  .676E+04  .225E+04      0.000    608.900    372.610  .982E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     3  1  9  .669E+04  .225E+04      0.000    607.137    373.910  .981E+03
OBJECTIVE FUNCTION FOR VARIABLE 1       .9819E+03       .9815E+03       .9810E+03
                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  7  1  .863E+03  .455E+04      0.000    546.666    454.123  .100E+04

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  7  1  .863E+03  .614E+04      0.000    593.204    390.554  .984E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  7  1  .863E+03  .662E+04      0.000    605.380    375.403  .981E+03
VAR  1 ADJ FROM        6824.62 TO        6619.88
                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     2  7  1  .854E+03  .662E+04      0.000    604.747    376.040  .981E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     3  7  1  .845E+03  .662E+04      0.000    604.114    376.619  .981E+03
OBJECTIVE FUNCTION FOR VARIABLE 7       .9808E+03       .9808E+03       .9807E+03
                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  9  7  .225E+04  .129E+04      0.000    636.203    350.384  .987E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  9  7  .225E+04  .992E+03      0.000    614.872    366.428  .983E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  9  7  .225E+04  .901E+03      0.000    608.227    373.110  .981E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     1  9  7  .225E+04  .863E+03      0.000    605.380    375.403  .981E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     2  9  7  .223E+04  .863E+03      0.000    603.852    377.068  .981E+03

                                                                    NC  M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                                     3  9  7  .221E+04  .863E+03      0.000    602.325    378.649  .981E+03
OBJECTIVE FUNCTION FOR VARIABLE 9       .9808E+03       .9809E+03       .9810E+03
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NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  1  9  .662E+04  .338E+04    0.000    681.762   312.015  .994E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  1  9  .662E+04  .259E+04    0.000    628.294   354.380  .983E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  1  9  .662E+04  .235E+04    0.000    612.254   368.885  .981E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  1  1  .662E+04  .662E+04    0.000    605.380   375.403  .981E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 2  1  1  .655E+04  .655E+04    0.000    603.088   377.223  .981E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 3  1  1  .649E+04  .649E+04    0.000    601.999   379.187  .981E+03

OBJECTIVE FUNCTION FOR VARIABLE 1      .9808E+03      .9809E+03      .9812E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  7  1  .803E+03  .664E+04    0.000    606.020   374.796  .981E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  7  1  .803E+03  .663E+04    0.000    605.572   375.221  .981E+03

NC  M M1    VAR(M)    VAR(M1)   OBJ DEV    TANCST      ANDMG O FTN(NC)
 1  7  1  .803E+03  .662E+04    0.000    605.438   375.348  .981E+03


**********      **********      **********      **********      **********

                     SUB-AREA RUNOFF COMPUTATION

      POTENTIAL RESERVOIR INFLOW
            ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME   ISTAGE   IAUTO
              10       0       0       2      0      0       1        0        0

                PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                              PLAN 1,RATIO 1
     6.      6.      7.      8.     13.     21.     48.     94.    129.    188.
   165.    178.    190.    200.    210.    226.    260.    325.    480.    750.
   987.   1150.   1270.   1340.   1343.   1275.   1150.    995.    833.    680.
   550.    460.    385.    313.    249.    194.    151.    118.     91.     70.
    54.     40.     30.     24.     19.     17.     15.     13.     12.     11.
    10.     10.      9.      8.      8.      8.      7.      7.      6.      6.
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Exhibit 5
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HYDROGRAPH ROUTING

PROPOSED RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
110	1	0	0	0	2	1	0	0

PLAN 1
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IOVR	LSTR
0.0	0.000	0.00	-1	0	0	0	0	0

PLAN 2
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IOVR	LSTR
0.0	0.000	0.00	1	0	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

RESERVOIR DATA

CAPMX	CAPMN	CQRL	ELEVL	EXPL	CQRW	RANCST	RDSCNT	CQRT	ELEVT	EXPT
25000.	0.	200.00	975.00	.50	100.00	.0230	.0504	0.00	975.00	0.00

CAPACITY=	0.	2500.	4000.	5200.	6800.	9000.	11500.	15500.	21000.	30000.
ELEVATION=	965.	1000.	1015.	1030.	1045.	1060.	1075.	1090.	1105.	1120.
COST=	0.	1500.	2400.	3000.	3600.	4350.	4950.	5550.	6000.	7200.

OUTLET CREST ELEVATION IS 1043.31 AT STORAGE OF 6620.

SYNTHETIC STORAGE OUTFLOW FUNCTION

STORAGE=	714.	1019.	1934.	3843.	6620.	10590.	14154.	18388.	23648.	30000.
OUTFLOW=	0.	413.	827.	1240.	1653.	15376.	28960.	42512.	56045.	69566.

STATION 110, PLAN 2, RTIO 1

OUTFLOW

6.	6.	6.	6.	7.	8.	11.	17.	27.	39.
51.	64.	77.	89.	101.	114.	128.	145.	172.	219.
288.	371.	429.	461.	494.	524.	549.	568.	581.	587.
588.	585.	579.	571.	560.	548.	534.	519.	504.	489.
473.	457.	442.	427.	409.	367.	330.	297.	266.	239.
215.	193.	174.	156.	141.	126.	114.	102.	92.	83.

STOR

719.	719.	719.	719.	719.	720.	722.	727.	734.	743.
752.	761.	771.	780.	789.	798.	808.	821.	841.	876.
927.	988.	1055.	1126.	1197.	1263.	1319.	1362.	1390.	1404.
1406.	1400.	1386.	1366.	1344.	1317.	1286.	1254.	1220.	1186.
1151.	1117.	1082.	1049.	1016.	985.	958.	933.	911.	891.
873.	857.	843.	830.	818.	808.	798.	790.	782.	776.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	588.	562.	510.	279.	16724.
CMS	17.	16.	14.	8.	474.
INCHES		.15	.54	.74	.74
MM		3.92	13.74	18.76	18.76
AC-FT		289.	1013.	1383.	1383.
THOUS CU M		356.	1249.	1706.	1706.

MAXIMUM STORAGE = 1406.

Several pages of printout deleted

STATION 110, PLAN 2, RTIO 8

OUTFLOW

78.	78.	78.	80.	86.	100.	137.	220.	350.	444.
502.	566.	632.	702.	774.	838.	879.	931.	1007.	1131.
1289.	1443.	1618.	4763.	7931.	10201.	11591.	12179.	12104.	11536.
10651.	9630.	8596.	7580.	6598.	5667.	4811.	4065.	3373.	2792.
2295.	1874.	1648.	1631.	1614.	1597.	1580.	1563.	1546.	1529.
1512.	1495.	1478.	1461.	1445.	1428.	1412.	1396.	1380.	1364.

STOR

772.	772.	772.	773.	778.	788.	815.	876.	972.	1088.
1217.	1357.	1505.	1659.	1818.	1987.	2177.	2416.	2767.	3339.
4172.	5208.	6381.	7520.	8436.	9093.	9495.	9665.	9644.	9479.
9223.	8928.	8629.	8335.	8050.	7781.	7534.	7312.	7118.	6949.
6806.	6694.	6576.	6469.	6358.	6245.	6130.	6016.	5901.	5786.
5671.	5558.	5444.	5332.	5221.	5110.	5000.	4892.	4784.	4678.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12179.	11377.	6097.	2988.	179258.
CMS	345.	322.	173.	85.	5076.
INCHES		3.02	6.46	7.92	7.92
MM		76.58	164.16	201.12	201.12
AC-FT		5644.	12099.	14822.	14822.
THOUS CU M		6962.	14924.	18283.	18283.

MAXIMUM STORAGE = 9665.

STATION 110, PLAN 2, RTIO 9

RESERVOIR	CAP COST	TOT ANN $
6619.9	3532.	259.

OUTFLOW

106.	106.	106.	109.	116.	136.	185.	298.	434.	507.
589.	678.	772.	887.	896.	949.	1008.	1081.	1187.	1321.
1492.	2688.	7339.	11245.	14335.	16610.	17897.	18164.	17597.	16430.
14943.	13430.	11931.	10483.	9098.	7797.	6607.	5547.	4620.	3820.
3137.	2559.	2074.	1673.	1638.	1622.	1606.	1589.	1572.	1555.
1539.	1522.	1505.	1489.	1472.	1456.	1440.	1424.	1408.	1392.

STOR

792.	792.	793.	794.	800.	814.	851.	934.	1065.	1227.
1409.	1606.	1813.	2030.	2256.	2498.	2772.	3109.	3599.	4390.
5537.	6919.	8265.	9395.	10289.	10914.	11252.	11322.	11173.	10867.
10465.	10027.	9594.	9175.	8774.	8398.	8053.	7746.	7478.	7247.
7049.	6882.	6742.	6626.	6520.	6412.	6301.	6189.	6077.	5964.
5851.	5739.	5627.	5516.	5405.	5295.	5186.	5078.	4970.	4864.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	18164.	16940.	9236.	4266.	257174.
CMS	514.	480.	262.	121.	7282.
INCHES		4.49	9.79	11.36	11.36
MM		114.03	248.69	288.53	288.53
AC-FT		8404.	18329.	21265.	21265.
THOUS CU M		10367.	22608.	26230.	26230.

MAXIMUM STORAGE = 11322.

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HYDROGRAPH ROUTING

POTENTIAL CHANNEL MODIFICATION REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6300.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 1030, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	289.	17369.
CMS	27.	26.	17.	8.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

MAXIMUM STORAGE = 434.

STATION 1030, PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

Several pages of printout deleted

MAXIMUM STORAGE = 4302.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	IRGT	DGPRT	IAQST	ADSCNT	AANCST	ILPR
1030	16	3	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1131.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4600.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	6480.	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8500.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15100.	44.300	1.500	15.000	27.800
.005	21000.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.244	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.98	.07	.30	.61
3	1940.	3.697	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.156	3.70	.14	1.08	2.49
8	15177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97

FLOOD DAMAGES FOR STATION 1030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	525.	6.000	.244	0.00	0.00	0.00	0.00
2	594.	5.462	1.752	0.00	0.00	0.00	0.00
3	638.	3.697	1.776	0.00	0.00	0.00	0.00
4	1005.	1.769	1.072	0.00	0.00	0.00	0.00
5	1252.	.867	.785	.62	.04	.19	.38
6	1583.	.323	.391	1.26	.08	.38	.80
7	5038.	.095	.156	1.67	.07	.48	1.11
8	10185.	.020	.037	1.00	.04	.29	.67
9	15470.	.006	.014	.58	.02	.19	.36
		AVG ANN DMG		5.11	.24	1.54	3.33
		AVG ANN BFT		28.46	1.35	8.48	18.63

```
                              SUB-AREA RUNOFF COMPUTATION
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       20       0       0       2       0       0       0       0       0

                       PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                     PLAN 1,RATIO 1
      6.        6.        7.        8.       13.       21.       48.       94.      129.      148.
    165.      178.      190.      200.      210.      228.      260.      323.      480.      750.
    987.     1150.     1270.     1340.     1343.     1275.     1150.      995.      833.      680.
    550.      460.      385.      313.      249.      194.      151.      118.       91.       70.
     54.       40.       30.       24.       19.       17.       15.       13.       12.       11.
     10.       10.        9.        8.        8.        8.        7.        7.        6.        6.


 **********          **********          **********          **********          **********

                                   HYDROGRAPH ROUTING

            DUMMY RESERVOIR TO ACCOMODATE DIVERSION
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       20       1       0       0       0       2       1       0       0

                                         PLAN 1
                                      ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
              0.0   0.000    0.00      -1       0       0       0       0       0

                                         PLAN 2
                                      ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
              0.0   0.000    0.00       1       0       0       0       7       0

                    NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                        1       0       0   0.000   0.000   0.000     -1.

STORAGE=       0.     2000.        0.        0.        0.        0.        0.        0.        0.        0.
OUTFLOW=       0.   100000.        0.        0.        0.        0.        0.        0.        0.        0.

                                     DIVERSION DATA
                            DVRMX   DVRMN   THDVR  DANCST  DDSCNT
                           20000.      0.   1500.  .01500  .05040

CAPACITY=       0.     1250.     2500.     3750.     5000.     7500.    10000.    15000.    20000.        0.
    COST=       0.     1500.     2600.     3400.     4200.     5200.     6100.     7500.     8300.        0.

                             STATION      20, PLAN 2, RTIO 1

                                         OUTFLOW
      6.        6.        6.        8.       11.       19.       40.       81.      122.      144.
    161.      175.      187.      198.      207.      223.      251.      305.      435.      678.
    935.     1115.     1243.     1327.     1346.     1296.     1184.     1034.      872.      716.
    580.      479.      403.      330.      263.      207.      161.      125.       97.       75.
     57.       43.       32.       25.       20.       17.       15.       14.       12.       11.
     10.       10.        9.        8.        8.        7.        7.        7.        6.        6.
```

STOR

0.	0.	0.	0.	0.	0.	1.	2.	2.	3.
3.	3.	4.	4.	4.	4.	5.	6.	9.	14.
19.	22.	25.	27.	27.	26.	24.	21.	17.	14.
12.	10.	8.	7.	5.	4.	3.	3.	2.	1.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1346.	1252.	659.	290.	17375.
CMS	38.	35.	19.	8.	492.
INCHES		.33	.70	.77	.77
MM		8.43	17.74	19.49	19.49
AC-FT		621.	1307.	1437.	1437.
THOUS CU M		766.	1613.	1772.	1772.

MAXIMUM STORAGE = 27.

STATION 20, PLAN 2, RTIO 2

OUTFLOW

7.	7.	8.	9.	14.	23.	48.	98.	146.	173.
193.	210.	224.	237.	249.	267.	301.	366.	522.	813.
1122.	1338.	1492.	1446.	1517.	1549.	1422.	1240.	1047.	859.
696.	575.	483.	396.	316.	248.	193.	150.	117.	90.
69.	52.	39.	30.	24.	20.	18.	16.	15.	13.
12.	12.	11.	10.	9.	9.	9.	8.	8.	7.

STOR

0.	0.	0.	0.	0.	0.	1.	2.	3.	3.
4.	4.	4.	5.	5.	5.	6.	7.	10.	16.
22.	27.	30.	29.	30.	31.	28.	25.	21.	17.
14.	11.	10.	8.	6.	5.	4.	3.	2.	2.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	106.	111.	30.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1549.	1461.	780.	343.	20601.
CMS	44.	41.	22.	10.	583.
INCHES		.39	.83	.91	.91
MM		9.83	21.01	23.11	23.11
AC-FT		725.	1548.	1703.	1703.
THOUS CU M		894.	1910.	2101.	2101.

MAXIMUM STORAGE = 31.

STATION 20, PLAN 2, RTIO 3

OUTFLOW

12.	12.	13.	15.	23.	38.	80.	165.	245.	288.
321.	350.	374.	396.	415.	445.	502.	610.	869.	1355.
1230.	1375.	1621.	1791.	1830.	1729.	1589.	1678.	1657.	1462.
1149.	962.	804.	660.	527.	413.	321.	250.	194.	150.
115.	86.	64.	50.	41.	34.	30.	27.	25.	22.
20.	19.	18.	17.	15.	15.	15.	14.	13.	12.

STOR

0.	0.	0.	0.	0.	1.	2.	3.	5.	6.
6.	7.	7.	8.	8.	9.	10.	12.	17.	27.
25.	27.	32.	36.	37.	35.	32.	34.	33.	29.
23.	19.	16.	13.	11.	8.	6.	5.	4.	3.
2.	2.	1.	1.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
475.	800.	863.	863.	863.	863.	800.	490.	165.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1830.	1712.	1060.	476.	28570.
CMS	52.	48.	30.	13.	809.
INCHES		.45	1.12	1.26	1.26
MM		11.53	28.55	32.05	32.05
AC-FT		850.	2104.	2362.	2362.
THOUS CU M		1048.	2595.	2914.	2914.

MAXIMUM STORAGE = 37.

STATION 20, PLAN 2, RTIO 4

OUTFLOW

17.	17.	18.	22.	32.	53.	111.	228.	341.	403.
450.	490.	523.	554.	581.	623.	703.	855.	1217.	1898.
1456.	2364.	2582.	2865.	2903.	2767.	2451.	2033.	1621.	1746.
1660.	1328.	1132.	922.	738.	578.	450.	351.	272.	210.
161.	121.	90.	70.	57.	48.	42.	38.	35.	31.
28.	27.	25.	23.	22.	21.	21.	19.	18.	17.

STOR

0.	0.	0.	0.	1.	1.	2.	5.	7.	8.
9.	10.	10.	11.	12.	12.	14.	17.	24.	38.
29.	47.	52.	57.	58.	55.	49.	41.	32.	35.
33.	27.	23.	18.	15.	12.	9.	7.	5.	4.
3.	2.	2.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
863.	863.	863.	863.	863.	863.	863.	863.	831.	404.
40.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2903.	2655.	1504.	675.	40475.
CMS	82.	75.	43.	19.	1146.
INCHES		.70	1.59	1.79	1.79
MM		17.87	40.50	45.41	45.41
AC-FT		1317.	2985.	3347.	3347.
THOUS CU M		1625.	3682.	4128.	4128.

MAXIMUM STORAGE = 58.

STATION 20, PLAN 2, RTIO 5

OUTFLOW

24.	24.	25.	31.	45.	75.	159.	325.	487.	575.
642.	700.	747.	791.	830.	891.	1004.	1221.	1739.	1548.
2982.	3562.	4122.	4439.	4524.	4320.	3872.	3273.	2625.	2002.
1676.	1681.	1639.	1310.	1057.	825.	643.	501.	389.	300.
229.	173.	129.	100.	81.	68.	61.	54.	50.	44.
40.	39.	36.	33.	31.	30.	29.	28.	25.	25.

STOR

0.	0.	1.	1.	1.	2.	3.	7.	10.	12.
13.	14.	15.	16.	17.	18.	20.	24.	35.	31.
60.	71.	82.	89.	90.	86.	77.	65.	53.	40.
34.	34.	33.	26.	21.	17.	13.	10.	8.	6.
5.	3.	3.	2.	2.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
700.	340.	40.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4524.	4140.	2195.	982.	58932.
CMS	128.	117.	62.	28.	1669.
INCHES		1.10	2.33	2.60	2.60
MM		27.87	59.11	66.12	66.12
AC-FT		2054.	4356.	4873.	4873.
THOUS CU M		2533.	5373.	6011.	6011.

MAXIMUM STORAGE = 90.

STATION 20, PLAN 2, RTIO 6

OUTFLOW

36.	36.	38.	46.	68.	113.	239.	488.	730.	863.
963.	1050.	1121.	1187.	1245.	1336.	1506.	1245.	1649.	3237.
4737.	5833.	6594.	7097.	7215.	6912.	6239.	5341.	4369.	3434.
2617.	2011.	1625.	1750.	1661.	1212.	974.	748.	584.	449.
304.	259.	193.	150.	122.	102.	91.	82.	75.	66.
60.	58.	54.	50.	46.	45.	44.	41.	38.	37.

STOR

1.	1.	1.	1.	1.	2.	5.	10.	15.	17.
19.	21.	22.	24.	25.	27.	30.	25.	33.	65.
95.	117.	132.	142.	144.	138.	125.	107.	87.	69.
52.	40.	33.	35.	33.	24.	19.	15.	12.	9.
7.	5.	4.	3.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	435.	863.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	810.	375.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7215.	6648.	3382.	1509.	90555.
CMS	204.	188.	96.	43.	2564.
INCHES		1.76	3.59	4.00	4.00
MM		44.75	91.07	101.60	101.60
AC-FT		3298.	6712.	7488.	7488.
THOUS CU M		4069.	8279.	9236.	9236.

MAXIMUM STORAGE = 144.

STATION 20, PLAN 2, RTIO 7

OUTFLOW

53.	53.	56.	68.	99.	166.	350.	716.	1070.	1266.
1413.	1540.	1412.	1471.	1451.	1413.	1337.	1827.	2961.	5102.
7367.	8951.	10076.	10811.	10985.	10539.	9553.	8236.	6811.	5438.
4240.	3352.	2683.	2041.	1690.	1760.	1434.	1095.	857.	656.
505.	380.	283.	220.	178.	150.	133.	120.	110.	97.
88.	85.	79.	73.	66.	65.	65.	61.	56.	55.

STOR

1.	1.	1.	1.	2.	3.	7.	14.	21.	25.
28.	31.	28.	29.	29.	28.	27.	37.	59.	102.
147.	179.	202.	216.	220.	211.	191.	165.	136.	109.
85.	67.	54.	41.	34.	35.	29.	22.	17.	13.
10.	8.	6.	4.	4.	3.	3.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.	1.	1.	1.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	172.	260.	348.	502.	788.	863.	863.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	863.	863.	689.	205.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10985.	10153.	5064.	2255.	135273.
CMS	311.	287.	143.	64.	3831.
INCHES		2.69	5.37	5.98	5.98
MM		68.34	136.35	151.77	151.77
AC-FT		5037.	10049.	11185.	11185.
THOUS CU M		6213.	12395.	13797.	13797.

MAXIMUM STORAGE = 220.

STATION 20, PLAN 2, RTIO 8

OUTFLOW

78.	76.	82.	101.	147.	245.	517.	1058.	1581.	1307.
1414.	1421.	1563.	1711.	1834.	2032.	2402.	3105.	4788.	7948.
11295.	13635.	15296.	16383.	16640.	15981.	14524.	12578.	10473.	8446.
6676.	5364.	4375.	3427.	2563.	1823.	1760.	1705.	1236.	983.
742.	563.	417.	326.	263.	222.	197.	177.	162.	143.
130.	126.	116.	109.	100.	97.	96.	89.	83.	81.

STOR

2.	2.	2.	2.	3.	5.	10.	21.	32.	26.
28.	28.	31.	34.	37.	41.	48.	62.	96.	159.
226.	273.	306.	328.	333.	320.	290.	252.	209.	169.
134.	107.	87.	69.	51.	36.	35.	34.	25.	20.
15.	11.	8.	7.	5.	4.	4.	4.	3.	3.
3.	3.	2.	2.	2.	2.	2.	2.	2.	2.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	418.
645.	608.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	863.	863.	863.	863.	466.	28.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16640.	15410.	7711.	3380.	202810.
CMS	471.	436.	218.	96.	5743.
INCHES		4.08	8.17	8.96	8.96
MM		103.73	207.62	227.54	227.54
AC-FT		7645.	15302.	16770.	16770.
THOUS CU M		9430.	18875.	20685.	20685.

MAXIMUM STORAGE = 333.

STATION 20, PLAN 2, RTIO 9

DIVERSION	CAP COST	TOT ANN $
862.5	1035.	68.

OUTFLOW

106.	106.	112.	136.	199.	331.	700.	1432.	1109.	1728.
1943.	2224.	2423.	2621.	2789.	3057.	3556.	4509.	6787.	11065.
15597.	18765.	21014.	22485.	22833.	21941.	19968.	17334.	14484.	11739.
9383.	7567.	6228.	4944.	3775.	2773.	1965.	1739.	1728.	1511.
1012.	760.	566.	441.	357.	300.	266.	239.	219.	194.
176.	170.	157.	147.	136.	131.	129.	121.	112.	109.

STOR

2.	2.	2.	3.	4.	7.	14.	29.	22.	35.
39.	44.	48.	52.	56.	61.	71.	90.	136.	221.
312.	375.	420.	450.	457.	439.	399.	347.	290.	235.
187.	151.	125.	99.	75.	55.	39.	35.	35.	26.
20.	15.	11.	9.	7.	6.	5.	5.	4.	4.
4.	3.	3.	3.	3.	3.	3.	2.	2.	2.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	766.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	863.	863.	863.	863.	863.	863.	863.	863.
863.	863.	863.	863.	863.	863.	863.	568.	106.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	22833.	21168.	10733.	4670.	280209.
CMS	647.	599.	304.	132.	7935.
INCHES		5.61	11.38	12.38	12.38
MM		142.49	289.01	314.38	314.38
AC-FT		10502.	21300.	23170.	23170.
THOUS CU M		12954.	26273.	28579.	28579.

MAXIMUM STORAGE = 457.

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**********          **********          **********          **********          **********

                              HYDROGRAPH ROUTING

           POTENTIAL LEVEE AND/OR BYPASS REACH
                 ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  2030       1       1       0       0       0       1       0       0

                                   ALL PLANS HAVE SAME
                                      ROUTING DATA
           QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
             0.0   0.000    0.00       1       1       0       0       0       0

                   NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                       1       0       0   0.000   0.000   0.000     -1.

STORAGE=      0.       50.      475.      940.     2135.     3080.     6300.       0.        0.        0.
OUTFLOW=      0.      200.     1020.     2050.     6100.    10250.    24000.       0.        0.        0.

                        STATION    2030, PLAN 1, RTIO 1

                      PEAK    6-HOUR   24-HOUR   72-HOUR    TOTAL VOLUME
           CFS        941.      907.      613.      289.          17369.
           CMS         27.       26.       17.        8.            492.
        INCHES                   .24       .65       .77             .77
            MM                  6.10     16.51     19.49           19.49
         AC-FT                  450.     1217.     1436.           1436.
    THOUS CU M                  555.     1501.     1772.           1772.

                        MAXIMUM STORAGE =      434.

                        STATION    2030, PLAN 1, RTIO 2

                      PEAK    6-HOUR   24-HOUR   72-HOUR    TOTAL VOLUME
           CFS       1139.     1091.      733.      347.          20842.
           CMS         32.       31.       21.       10.            590.
        INCHES                   .29       .78       .92             .92
            MM                  7.34     19.73     23.38           23.38
         AC-FT                  541.     1454.     1723.           1723.
    THOUS CU M                  668.     1794.     2126.           2126.

                        MAXIMUM STORAGE =      529.

                        STATION    2030, PLAN 1, RTIO 3

                      PEAK    6-HOUR   24-HOUR   72-HOUR    TOTAL VOLUME
           CFS       1940.     1859.     1220.      579.          34733.
           CMS         55.       53.       35.       16.            984.
        INCHES                   .49      1.29      1.53            1.53
            MM                 12.52     32.84     38.97           38.97
         AC-FT                  922.     2420.     2872.           2872.
    THOUS CU M                 1138.     2985.     3543.           3543.

                        MAXIMUM STORAGE =      890.
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EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IADBT	ADBCNT	AANCBT	ILPR
2030	16	1	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.600	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6480.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCO FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.98	.98
3	1940.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.58	6.58
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
		AVG ANN DMG		33.58	33.58

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCO FREQ	PROB INT	SUM	TYPE 1
1	940.	6.000	.284	0.00	0.00
2	1115.	5.462	1.752	.33	.33
3	1830.	3.097	1.776	2.86	2.86
4	2080.	1.769	1.072	4.28	4.28
5	3507.	.867	.785	6.06	6.06
6	5756.	.323	.391	5.48	5.48
7	9253.	.095	.136	3.33	3.33
8	18254.	.020	.037	1.43	1.43
9	19694.	.006	.014	.65	.65
		AVG ANN DMG		24.42	24.42
		AVG ANN BFT		9.16	9.16

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	0	0	2	0	0	1	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1, RATIO 1

2.	2.	2.	3.	4.	7.	16.	31.	43.	49.
55.	58.	64.	66.	70.	76.	88.	108.	160.	250.
330.	385.	413.	450.	453.	423.	383.	333.	278.	225.
183.	154.	129.	104.	83.	64.	50.	39.	30.	23.
18.	14.	10.	8.	7.	6.	5.	5.	4.	4.
3.	3.	3.	3.	3.	3.	3.	2.	2.	2.

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COMBINE HYDROGRAPHS

COMBINED INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	3	0	0	0	0	1	0	0

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2219.	21:7.	1433.	675.	40523.
CMS	63.	61.	41.	19.	1147.
INCHES		.25	.66	.78	.78
MM		6.30	16.89	19.90	19.90
AC-FT		1060.	2844.	3351.	3351.
THOUS CU M		1308.	3508.	4133.	4133.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2676.	2571.	1713.	810.	48626.
CMS	76.	73.	49.	23.	1377.
INCHES		.30	.79	.94	.94
MM		7.57	20.19	23.88	23.88
AC-FT		1275.	3400.	4021.	4021.
THOUS CU M		1573.	4194.	4960.	4960.

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4563.	4375.	2851.	1351.	81034.
CMS	129.	124.	81.	38.	2295.
INCHES		.51	1.32	1.57	1.57
MM		12.89	33.60	39.79	39.79
AC-FT		2171.	5658.	6700.	6700.
THOUS CU M		2678.	6980.	8265.	8265.

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                                        HYDROGRAPH ROUTING

                 PROPOSED PUMPING PLANT SITE
                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            305       1       1       0       0       2       1       0       0

                                             PLAN 1
                                          ROUTING DATA
                 QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
                   0.0   0.000    0.00       1       0       0       0       0       1

                          NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                              1       0       0   0.000   0.000   0.000     -1.

STORAGE=        0.       400.   100000.        0.        0.        0.        0.        0.        0.        0.
OUTFLOW=        0.      1200.     1200.        0.        0.        0.        0.        0.        0.        0.

                                      STATION    305, PLAN 1, RTIO 1

                                              OUTFLOW
          14.        14.        14.        14.        15.        17.        22.        33.        53.        81.
         114.       150.       187.       225.       262.       298.       335.       374.       421.       492.
         597.       735.       897.      1078.      1200.      1200.      1200.      1200.      1200.      1200.
        1200.      1200.      1200.      1200.      1200.      1200.      1200.      1200.      1200.      1200.
        1200.      1200.      1200.      1200.      1200.      1200.      1200.      1200.      1069.       855.
         685.       546.       437.       350.       280.       225.       181.       147.       119.        97.

                                                STOR
           5.         5.         5.         5.         5.         6.         7.        11.        18.        27.
          38.        50.        62.        75.        87.        99.       112.       125.       140.       164.
         199.       245.       299.       359.       425.       499.       581.       665.       746.       821.
         885.       939.       981.      1011.      1030.      1036.      1032.      1017.       992.       958.
         916.       867.       811.       749.       681.       606.       525.       439.       356.       285.
         228.       182.       146.       117.        93.        75.        60.        49.        40.        32.

                             PEAK    6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                    CFS     1200.     1200.      1200.       670.          40227.
                    CMS       34.       34.        34.        19.           1139.
                 INCHES                 .14        .56        .78             .78
                     MM                3.54      14.14      19.75           19.75
                  AC-FT                 595.      2381.      3326.           3326.
            THOUS CU M                 734.      2937.      4103.           4103.

                                    MAXIMUM STORAGE =      1036.
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Exhibit 5
26 of 34

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PLAN 2
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	9	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

PUMPING PLANT DATA

PMPMX	PMPMN	PMPUN	PMRCST	PANCST	PDSCNT
10000.	0.	1500.	100.	.02300	.05040

CAPACITY=	0.	250.	500.	1000.	2000.	6000.	8000.	10000.	0.	0.
COST=	0.	670.	1000.	1600.	2300.	6000.	7860.	8670.	0.	0.

STATION 305, PLAN 2, RTIO 1

OUTFLOW

14.	14.	14.	14.	15.	16.	19.	27.	40.	58.
80.	105.	131.	159.	188.	216.	247.	280.	321.	381.
466.	574.	697.	831.	968.	1099.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1150.	1035.	934.	845.	766.	696.
634.	578.	529.	484.	444.	407.	374.	344.	315.	287.

STOR

5.	5.	5.	5.	5.	5.	6.	9.	13.	19.
27.	35.	44.	53.	63.	72.	82.	93.	107.	127.
155.	191.	232.	277.	323.	366.	406.	443.	480.	514.
543.	566.	586.	600.	607.	607.	602.	592.	575.	554.
528.	497.	462.	424.	383.	345.	311.	282.	255.	232.
211.	193.	176.	161.	146.	136.	125.	115.	105.	96.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1151.	640.	38396.
CMS	34.	34.	33.	18.	1087.
INCHES		.14	.53	.74	.74
MM		3.54	13.57	18.85	18.85
AC-FT		595.	2285.	3175.	3175.
THOUS CU M		734.	2818.	3916.	3916.

MAXIMUM STORAGE = 607.

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STATION 305, PLAN 2, RTIO 8

OUTFLOW

182.	182.	182.	184.	191.	207.	248.	337.	480.	660.
857.	1056.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

61.	61.	61.	61.	64.	69.	83.	112.	160.	220.
286.	352.	421.	501.	599.	717.	860.	1041.	1290.	1680.
2691.	2731.	3605.	4716.	6052.	7589.	9291.	11100.	12946.	14752.
16459.	18028.	19432.	20669.	21737.	22645.	23405.	24030.	24540.	24949.
25265.	25500.	25666.	25773.	25831.	25851.	25840.	25805.	25753.	25686.
25607.	25518.	25419.	25312.	25198.	25077.	24951.	24819.	24683.	24543.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1039.	62346.
CMS	34.	34.	34.	29.	1766.
INCHES		.14	.56	1.21	1.21
MM		3.54	14.14	30.62	30.62
AC-FT		595.	2361.	5157.	5157.
THOUS CU M		734.	2937.	6361.	6361.

MAXIMUM STORAGE = 25851.

STATION 305, PLAN 2, RTIO 9

VPMP=1917028.
VOLP=2069869.

PUMPING	CAP COST	PWR COST	TOT ANN $
2250.0	2531.	93.	278.

OUTFLOW

246.	246.	247.	250.	258.	280.	333.	447.	626.	839.
1073.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

82.	82.	82.	83.	86.	93.	111.	149.	204.	280.
359.	446.	557.	698.	865.	1063.	1298.	1591.	1807.	2219.
2913.	3940.	5312.	7058.	9193.	11666.	14395.	17260.	20134.	22907.
25502.	27875.	30009.	31892.	33524.	34909.	36071.	37034.	37823.	38458.
38960.	39350.	39645.	39858.	40004.	40093.	40137.	40146.	40126.	40085.
40028.	39958.	39876.	39785.	39685.	39577.	39462.	39342.	39216.	39085.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.
2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.	2250.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1061.	63646.
CMS	34.	34.	34.	30.	1802.
INCHES		.14	.56	1.23	1.23
MM		3.54	14.14	31.25	31.25
AC-FT		595.	2381.	5263.	5263.
THOUS CU M		734.	2937.	6491.	6491.

MAXIMUM STORAGE = 40146.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPKT	IADST	ADSCNT	AANCST	IUPR
305	10	2	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 305 PLAN 1

FREQ	STOR	SUM	TYPE 1	TYPE 2
.700	1500.	0.000	0.000	0.000
.600	23[illegible].	48.000	37.500	10.500
.35[illegible]	4[illegible].	9[illegible]	75.000	15.000
.250	7[illegible].	1177.500	1125.000	52.500
.100	125[illegible].	3255.000	3150.000	105.000
.050	2[illegible].	6052.500	5850.000	202.500
.020	28000.	7350.000	7050.000	300.000
.010	37000.	9390.000	9010.000	390.000
.005	50000.	11190.000	10650.000	540.000
.002	76000.	11835.000	11250.000	585.000

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 305 PLAN 1

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1456.	.700	.152	2.02	1.58	.44
3	3587.	.480	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15975.	.075	.075	311.36	300.95	10.41
7	23937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40

FLOOD DAMAGES FOR STATION 305 PLAN 2

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	607.	.700	0.000	0.00	0.00	0.00
2	882.	.700	.152	0.00	0.00	0.00
3	1552.	.480	.197	.35	.27	.08
4	1596.	.311	.150	1.80	1.40	.40
5	2659.	.169	.119	5.64	5.36	1.28
6	5655.	.075	.075	60.99	58.15	2.84
7	13353.	.030	.037	126.39	122.15	4.24
8	25651.	.009	.013	82.30	79.08	3.23
9	40146.	.004	.008	67.39	64.48	2.91
		AVG ANN DMG		345.87	330.89	14.98
		AVG ANN BFT		764.34	733.92	30.42

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .25	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 1.00	RATIO 6 1.50	RATIO 7 2.20	RATIO 8 3.25	RATIO 9 4.40
				RATIOS APPLIED TO FLOWS								
HYDROGRAPH AT	10	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	110	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	586.	666.	909.	1085.	1324.	1758.	6435.	12179.	18164.
			(	16.65)(	18.86)(	25.73)(	30.72)(	37.48)(	49.78)(	182.21)(	344.86)(	514.34)
ROUTED TO	1030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	525.	594.	838.	1005.	1252.	1583.	5038.	10185.	15470.
			(	14.86)(	16.83)(	23.73)(	28.47)(	35.46)(	44.83)(	142.65)(	288.41)(	438.05)
HYDROGRAPH AT	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1346.	1549.	1830.	2903.	4524.	7215.	10985.	16640.	22833.
			(	38.12)(	43.86)(	51.82)(	82.20)(	128.12)(	204.32)(	311.07)(	471.20)(	646.57)
ROUTED TO	2030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	940.	1115.	1430.	2080.	3507.	5756.	9253.	14254.	19694.
			(	26.61)(	31.56)(	40.49)(	58.90)(	99.31)(	162.98)(	262.02)(	403.64)(	557.67)
HYDROGRAPH AT	30	10.00	1	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
	(	25.90)	(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
			2	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
			(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
3 COMBINED	30	80.20	1	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
	(	207.72)	(	62.84)(	75.79)(	129.21)(	194.23)(	287.53)(	444.39)(	672.47)(	1000.86)(	1359.53)
			2	1660.	1939.	2602.	3752.	5793.	8998.	14293.	25799.	38535.
			(	46.99)(	54.90)(	73.67)(	106.25)(	164.05)(	254.81)(	404.74)(	730.54)(	1091.19)
ROUTED TO	305	80.20	1	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
	(	207.72)	(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			2	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
			(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			PEAK STORAGES IN ACRE FEET (1000 CUBIC METERS)									
			1	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
			(	1278.)(	1833.)(	4424.)(	7283.)(	11788.)(	19583.)(	30760.)(	47734.)(	66455.)
			2	607.	882.	1552.	1596.	2659.	5655.	13353.	25851.	40146.
			(	749.)(	1088.)(	1914.)(	1968.)(	3280.)(	6975.)(	16471.)(	31887.)(	49519.)

SYSTEM OPTIMIZATION RESULTS

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	DIV 7	DIV 8	PMP 9	PMP 10
[illegible]	0.	0.	0.	0.	0.	663.	0.	2250.	0.

SYSTEM COST AND PERFORMANCE SUMMARY
(UNITS SAME AS INPUT - NORMALLY 1000'S OF DOLLARS)

TOTAL SYSTEM CAPITAL COST * * * * * * * * * * * * * *	7099.	
TOTAL SYSTEM AMORTIZED CAPITAL COST * * * * * * * * *	358.	
TOTAL SYSTEM ANNUAL O.M.POWER AND REPLACEMENT COST *	248.	
TOTAL SYSTEM ANNUAL COST * * * * * * * * * * * * * *		605.
AVERAGE ANNUAL DAMAGES -- EXISTING CONDITIONS * * * *	1177.	
AVERAGE ANNUAL DAMAGES -- OPTIMIZED SYSTEM * * * * *	375.	
AVERAGE ANNUAL DAMAGE REDUCTION (BENEFITS) * * * * *		802.
AVERAGE ANNUAL SYSTEM NET BENEFITS * * * * * * * * *		197.

***** OPTIMIZATION OBJECTIVE = MAXIMIZE SYSTEM NET BENEFITS *****

TFCST	ANFCST	ANOMPR	TANCST	ANDGBB	ANDMG	TBNFTS	NTBNFT
4600.	232.	201.	433.	1177.	632.	546.	113.

EXHIBIT 6

SIZING LEVEE AND CHANNEL MODIFICATION

(Unconstrained)

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A        FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
R-A      SIZING LEVEL AND CHANNEL MODIFICATION
R-A      UNCONSTRAINED
B     40        1                                                          3
1      6
J      2        9        1
1   0.25     0.30     0.50     0.70     1.00     1.50     2.20     3.25     4.40
R-2         -2000    -2000
B
K      0       10                                           1
1        POTENTIAL RESERVOIR INFLOW
H     -1              35.1                                                 1
N     24       24       26       33       50       85      190      375      515      590
N    660      710      760      800      840      910     1040     1290     1920     3000
N   3950     4600     5080     5360     5370     5100     4600     3980     3330     2720
N   2200     1840     1540     1250      995      775      605      470      365      280
N    215      160      120       95       77       66       59       53       49       42
N     40       38       35       33       30       30       29       27       25       25
K      1     1030        1                                  1
1        POTENTIAL CHANNEL MODIFICATION REACH
Y                                 1        1                               0
1      1                                                   -1
2      0       50      475      940     2135     3080     6300
3      0      200     1020     2050     6100    10250    24000
Z   1030       16        3      (0)                                            (2)
1      6      5.5      4.5      3.5      2.5      1.5       .9       .7       .5      .35
1    .25      .15      .10      .05      .02     .005
2   1030     1130     1380     1740     2280     3200     4220     4800     5620     6480
2   7340     8540    10000    12100    15100    21000
3
4      0        0       .1       .2       .3       .3       .4       .5       .6       .7
4     .8       .9      1.0      1.2      1.5      1.8
4      0        0       .5       .7      1.5      2.2      2.9      3.5      4.0      4.7
4    5.8      6.6      8.0     10.3     15.0     18.1
4      0        0      1.0      1.5      3.2      4.7      6.5      7.8      9.3     11.0
4   13.7     15.6     19.0     25.0     27.8     30.2
N-/ 8300     1700     .023    .0508
1   1700     5000     5500     7000     8300     9300
2     42      103      149      222      283      340
3   1030     1130     1380     1740     2280     3200     4220     4800     5620     6480
3   7340     8540    10000    12100    15100    21000
4      0        0        0      .01      .14      .25      .36      .43      .55      .62
4    .69      .82      .97     1.17     1.43     1.76
4      0        0        0      .08      .95     1.73     2.53     2.73     3.53     4.08
4   5.01     6.16     7.70     9.90    14.08    17.51
4      0        0        0      .13     1.73     3.44     5.85     7.23     8.91    10.63
4  13.11    15.03    18.61    22.09    27.00    29.37
5      0        0        0        0        0        0        0        0        0        0
5      0      .04      .25      .42      .64      .99
5      0        0        0        0        0        0        0        0        0        0
5      0      .25     1.75     3.18     5.04     7.98
5      0        0        0        0        0        0        0        0        0        0
N-5    0      .44     3.50     7.15    12.29    16.86
K      0       20
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

	N	-1		35.1						1	
	N	24	24	26	33	50	85	190	375	515	590
	N	660	710	760	800	840	910	1040	1290	1920	3000
	N	3950	4600	5080	5360	5370	5100	4600	3980	3330	2720
	N	2200	1840	1540	1250	995	775	605	470	365	280
	N	215	160	120	95	77	66	59	53	49	42
	N	40	39	35	33	30	30	29	27	25	25
	K	1	2030	1				1			
	1	POTENTIAL LEVEE AND/OR BYPASS REACH									
	V				1	1				0	
	1	1						-1			
	2	0	50	475	940	2135	3080	6300			
	3	0	200	1020	2050	6100	10250	24000			
	Z	2030	16	1	8						3
	1	6	5.5	4.5	3.5	2.5	1.5	.9	.7	.5	.35
	1	.25	.15	.10	.05	.02	.005				
	2	1030	1130	1380	1740	2280	3200	4220	4800	5620	6480
	2	7340	8540	10000	12100	15100	21000				
	3										
	4	0	0	1.6	2.4	5.0	7.2	9.8	11.0	13.9	16.4
	4	20.3	23.1	28.0	34.5	44.3	50.1				
N-	/	8300	1700	.023	.0504						
	1	1700	5000	5500	7000	8300	9300				
	2	42	103	149	222	283	340				
	3	1030	1130	1380	1740	2280	3200	4220	4800	5620	6480
	3	7340	8540	10000	12100	15100	21000				
	4	0	0	1.6	2.4	5.0	7.2	9.8	11.0	13.9	16.4
	4	20.3	23.1	28.0	34.5	44.3	50.1				
	5	0	0	1.6	2.4	5.0	7.2	9.8	11.0	13.9	16.4
N-	5	20.3	23.1	28.0	34.5	44.3	50.1				
	K	0	30					1			
	1	LOCAL INFLOW TO FOREBAY POOL									
	N	-1		10.0						1	
	N	8	8	9	11	17	28	63	125	170	195
	N	220	230	255	265	280	305	350	430	640	1000
	N	1320	1540	1650	1800	1810	1690	1530	1330	1110	900
	N	730	615	515	415	330	255	200	155	120	93
	N	72	54	41	32	26	22	20	18	16	14
	N	13	12	11	11	11	10	10	9	9	9
	K	3	30					1			
	1	COMBINED INFLOW TO FOREBAY POOL									
	K	1	305					1			
	1	GRAVITY OUTLET THROUGH LEVEE									
	V				1	1					
	1	1						-1			
	2	0	400	100000							
	3	0	1200	1200							
	K	99									
	A										
	A										
	A										
	A										
	A										

<u>LEGEND</u>

N - NEW INPUT DATA

R - REVISED INPUT DATA

( ) - REVISED INPUT DATA

NOTE: DAMAGE REACH 305 OMITTED IN ORDER TO COMPARE THE RELATIVE EFFECTS OF THE CHANNEL AND LEVEE IN REDUCING DOWNSTREAM DAMAGES.

```
FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
SIZING LEVEE AND CHANNEL MODIFICATION
UNCONSTRAINED

                          JOB SPECIFICATION
      NO   NHR  NMIN  IDAY   IHR  IMIN METHC  IPLT  IPRT NSTAN
      60    1    0     0     0     0     0     0     3     0
                     JOPER   NMT LROPT TRACE
                       6     0     0     0

                         MULTI-PLAN ANALYSES TO BE PERFORMED
                          NPLAN= 2 NRTIO= 9 LRTIO= 1
 RTIOS=    .25    .30    .50    .70   1.00   1.50   2.20   3.25   4.40

                               SYSTEM OPTIMIZATION
 VAR 1     VAR 2     VAR 3     VAR 4     VAR 5     VAR 6     DIV 7     DIV 8     PMP 9     PMP 10
    0.    -2000.    -2000.       0.        0.        0.        0.        0.        0.        0.

                             FIXED COST INPUT
                          FCAP     FDCNT       FAN
                           0.     0.0000     0.0000
                           0.        0.         0.
                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   1  2  2  .200E+04  .200E+04    0.000     6.980    52.791  .598E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   2  2  2  .198E+04  .198E+04    0.000     6.953    52.965  .599E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   3  2  2  .196E+04  .196E+04    0.000     6.925    53.165  .601E+02
OBJECTIVE FUNCTION FOR VARIABLE 2     .5977E+02     .5992E+02     .6009E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   1  3  2  .200E+04  .210E+04    0.000     7.121    51.766  .589E+02
VAR  2 ADJ FROM      2000.00 TO      2104.43

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   2  3  2  .198E+04  .210E+04    0.000     7.094    51.766  .589E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   3  3  2  .196E+04  .210E+04    0.000     7.067    51.912  .590E+02
OBJECTIVE FUNCTION FOR VARIABLE 3     .5889E+02     .5886E+02     .5898E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   1  2  3  .210E+04  .199E+04    0.000     7.103    51.766  .589E+02
VAR  3 ADJ FROM      2090.00 TO      1986.30

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   2  2  3  .208E+04  .199E+04    0.000     7.074    51.972  .590E+02

                                  NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                   3  2  3  .206E+04  .199E+04    0.000     7.046    52.179  .592E+02
OBJECTIVE FUNCTION FOR VARIABLE 2     .5887E+02     .5905E+02     .5922E+02
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                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  3  2  .199E+04  .316E+04    0,000     8,550    43,966  .525E+02
VAR  2 ADJ FROM        2184,43 TO        3156,65

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       2  3  2  .197E+04  .316E+04    0,000     8,503    44,112  .526E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       3  3  2  .195E+04  .316E+04    0,000     8,477    44,254  .527E+02

OBJECTIVE FUNCTION FOR VARIABLE 3      .5250E+02      .526[illegible]E+02      .5273E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  2  3  .316E+04  .298E+04    0,000     9,878    37,259  .471E+02
VAR  3 ADJ FROM        1986,30 TO        2979,44

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       2  2  3  .313E+04  .298E+04    0,000     9,835    37,416  .473E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  2  3  .309E+04  .298E+04    0,000     9,792    37,596  .474E+02

OBJECTIVE FUNCTION FOR VARIABLE 2      .4712E+02      .4725E+02      .4739E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  3  2  .298E+04  .473E+04    0,000    12,019    30,881  .429E+02
VAR  2 ADJ FROM        3156,65 TO        4734,97

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       2  3  2  .295E+04  .473E+04    0,000    11,979    31,047  .430E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       3  3  2  .292E+04  .473E+04    0,000    11,938    31,211  .431E+02

OBJECTIVE FUNCTION FOR VARIABLE 3      .4290E+02      .4303E+02      .4315E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  2  3  .473E+04  .447E+04    0,000    14,041    23,604  .376E+02
VAR  3 ADJ FROM        2979,44 TO        4469,17

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       2  2  3  .469E+04  .447E+04    0,000    13,976    23,744  .377E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       3  2  3  .464E+04  .447E+04    0,000    13,912    23,885  .378E+02

OBJECTIVE FUNCTION FOR VARIABLE 2      .3764E+02      .3772E+02      .3780E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  3  2  .447E+04  .701E+04    0,000    23,176    19,277  .425E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  3  2  .447E+04  .542E+04    0,000    17,223    21,980  .391E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       1  3  2  .447E+04  .494E+04    0,000    14,319    23,053  .374E+02
VAR  2 ADJ FROM        4734,97 TO        4939,90

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       2  3  2  .442E+04  .494E+04    0,000    14,258    23,247  .375E+02

                                                                      NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST    ANDMG O FTN(NC)
                                                                       3  3  2  .438E+04  .494E+04    0,000    14,197    23,439  .376E+02

OBJECTIVE FUNCTION FOR VARIABLE 3      .3737E+02      .3751E+02      .3764E+02
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Exhibit 6

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                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  3  .494E+04  .670E+04    0.000    22.715    16.449   .392E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  3  .494E+04  .514E+04    0.000    15.981    20.683   .367E+02
VAR  3 ADJ FROM       4469.17 TO        5139.54

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  3  3  .514E+04  .514E+04    0.000    15.981    20.683   .367E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 2  3  3  .509E+04  .509E+04    0.000    15.634    20.913   .365E+02

                                                                NE  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 3  3  3  .504E+04  .504E+04    0.000    15.287    21.141   .364E+02

OBJECTIVE FUNCTION FOR VARIABLE 3      .3666E+02      .3655E+02      .3643E+02
                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  3  .494E+04  .343E+04    0.000    12.904    28.100   .410E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  3  .494E+04  .463E+04    0.000    14.531    22.653   .372E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ.DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  3  .494E+04  .499E+04    0.000    15.019    21.366   .364E+02
VAR  3 ADJ FROM       5139.54 TO        4985.36

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  2  2  .494E+04  .494E+04    0.000    15.019    21.366   .364E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 2  2  2  .489E+04  .489E+04    0.000    14.952    21.401   .364E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 3  2  2  .484E+04  .484E+04    0.000    14.885    21.619   .365E+02

OBJECTIVE FUNCTION FOR VARIABLE 2      .3639E+02      .3643E+02      .3650E+02

                                                                NC  M M1     VAR(M)    VAR(M1)   OBJ DEV    TANCST     ANDMG  O FTN(NC)
                                                                 1  3  2  .499E+04  .502E+04    0.000    15.210    21.154   .364E+02
VAR  2 ADJ FROM       4939.90 TO        5016.16


          **********          **********          **********          **********          **********

                                           SUB-AREA RUNOFF COMPUTATION

                       POTENTIAL RESERVOIR INFLOW
                                 ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME   ISTAGE   IAUTO
                                   10       0       0       2      0      0       1       0        0

                                    PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                                    PLAN 1,RATIO 1
          6.         6.         7.         8.        13.        21.        48.        94.       129.       148.
        165.       178.       190.       200.       210.       228.       260.       323.       480.       750.
        987.      1150.      1270.      1340.      1343.      1275.      1150.       995.       833.       680.
        550.       460.       385.       313.       249.       194.       151.       118.        91.        70.
         54.        40.        30.        24.        19.        17.        15.        13.        12.        11.
         10.        10.         9.         6.         6.         8.         7.         7.         6.         6.
```

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

POTENTIAL CHANNEL MODIFICATION REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6300.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 1030, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	289.	17369.
CMS	27.	26.	17.	8.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

MAXIMUM STORAGE = 434.

STATION 1030, PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1139.	1091.	733.	347.	20842.
CMS	32.	31.	21.	10.	590.
INCHES		.29	.78	.92	.92
MM		7.34	19.73	23.38	23.38
AC-FT		541.	1454.	1723.	1723.
THOUS CU M		668.	1794.	2126.	2126.

MAXIMUM STORAGE = 529.

STATION 1030, PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1940.	1859.	1220.	579.	34733.
CMS	55.	53.	35.	16.	984.
INCHES		.49	1.29	1.53	1.53
MM		12.52	32.84	38.97	38.97
AC-FT		922.	2420.	2872.	2872.
THOUS CU M		1138.	2985.	3543.	3543.

MAXIMUM STORAGE = 890.

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STATION 1030, PLAN 2, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20603.	19364.	11267.	5087.	305190.
CMS	583.	548.	319.	144.	8642.
INCHES		5.13	11.94	13.48	13.48
MM		130.35	303.38	342.41	342.41
AC-FT		9607.	22359.	25236.	25236.
THOUS CU M		11850.	27580.	31128.	31128.

MAXIMUM STORAGE = 5505.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IAGST	ADSCNT	AANCST	ILPR
1030	16	3	0	0.	0.000	0	0.00000	0.00000	2

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1130.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4800.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	6480.	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8540.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15100.	44.300	1.500	15.000	27.800
.005	21000.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	981.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.99	.07	.30	.62
3	1940.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.48
8	15177.	.020	.037	1.50	.05	.50	.95
9	20603.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97

LOCAL PROTECTION DATA

XLPMX	XLPMN	XANCST	XUSCNT
8300.	1700.	.02300	.05040

CAPACITY=	1700.	5000.	5500.	7000.	8300.	9300.	0.	0.	0.	0.
COST=	42.	103.	149.	222.	283.	340.	0.	0.	0.	0.

MINIMUM DESIGN DAMAGE FUNCTION

PEAK - - - CATEGORY DAMAGES			
1030.	0.00	0.00	0.00
1130.	0.00	0.00	0.00
1380.	0.00	0.00	0.00
1740.	.01	.08	.13
2280.	.14	.95	1.73
3200.	.25	1.73	3.48
4220.	.36	2.53	5.85
4800.	.43	2.73	7.23
5620.	.53	3.53	8.91
6480.	.62	4.08	10.63
7340.	.69	5.01	13.11
8540.	.82	6.16	15.03
10000.	.97	7.70	18.61
12100.	1.17	9.90	22.09
15100.	1.43	14.08	27.00
21000.	1.76	17.51	29.32

MAXIMUM DESIGN DAMAGE FUNCTION

PEAK - - - CATEGORY DAMAGES			
1030.	0.00	0.00	0.00
1130.	0.00	0.00	0.00
1380.	0.00	0.00	0.00
1740.	0.00	0.00	0.00
2280.	0.00	0.00	0.00
3200.	0.00	0.00	0.00
4220.	0.00	0.00	0.00
4800.	0.00	0.00	0.00
5620.	0.00	0.00	0.00
6480.	0.00	0.00	0.00
7340.	0.00	0.00	0.00
8540.	.04	.25	.44
10000.	.25	1.75	3.50
12100.	.42	3.18	7.15
15100.	.64	5.04	12.29
21000.	.99	7.98	16.86

INTERPOLATED ECONOMIC DATA FOR STATION 1030 PLAN 2

PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
1030.	0.000	0.000	0.000	0.000
1130.	0.000	0.000	0.000	0.000
1380.	0.000	0.000	0.000	0.000
1740.	0.000	0.000	0.000	0.000
2280.	0.000	0.000	0.000	0.000
3200.	0.000	0.000	0.000	0.000
5011.	0.000	0.000	0.000	0.000
5016.	1.619	.110	.424	1.086
5620.	3.519	.183	1.013	2.323
6480.	5.879	.273	1.563	4.043
7340.	9.359	.343	2.493	6.523
8540.	11.318	.428	3.191	7.699
10000.	16.337	.608	4.710	11.018
12100.	21.900	.793	6.524	14.583
15100.	30.180	1.033	9.539	19.609
21000.	37.154	1.373	12.722	23.059

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

```
FLOOD DAMAGES FOR STATION  1030   PLAN  2
              EXCD   PROB
NO.   FLOW    FREQ    INT         SUM      TYPE 1     TYPE 2     TYPE 3
 1     941.  6.000   .284        0.00       0.00       0.00       0.00
 2    1139.  5.462  1.752        0.00       0.00       0.00       0.00
 3    1940.  3.097  1.776        0.00       0.00       0.00       0.00
 4    2921.  1.769  1.072        0.00       0.00       0.00       0.00
 5    4312.   .867   .785         .35        .02        .10        .23
 6    6699.   .323   .391        2.61        .11        .71       1.79
 7   10191.   .095   .136        2.17        .08        .63       1.46
 8   15177.   .020   .037        1.02        .04        .33        .66
 9   20603.   .006   .014         .48        .02        .16        .30

          AVG ANN DMG            6.63        .27       1.93       4.44

          AVG ANN BFT           26.94       1.32       8.09      17.53

          LOCAL PROTECTION CAP COST =    104.   TOTAL ANNUAL =      8.   DESIGN Q =   50. .


     **********        **********        **********        **********        **********

                               SUB-AREA RUNOFF COMPUTATION
                 ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    20       0       0       2       0       0       0       0       0

                        PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                       PLAN 1,RATIO 1
      6.        6.        7.        8.       13.       21.       48.       94.      129.      148.
    165.      178.      190.      200.      210.      228.      260.      323.      480.      750.
    987.     1150.     1270.     1340.     1303.     1275.     1150.      995.      833.      680.
    550.      460.      385.      313.      249.      194.      151.      118.       91.       70.
     54.       40.       30.       24.       19.       17.       15.       13.       12.       11.
     10.       10.        9.        8.        8.        8.        7.        7.        6.        6.


     **********        **********        **********        **********        **********

                                  HYDROGRAPH ROUTING

            POTENTIAL LEVEE AND/OR BYPASS REACH
                 ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  2030       1       1       0       0       0       1       0       0

                                   ALL PLANS HAVE SAME
                                      ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
              0.0   0.000    0.00       1       1       0       0       0       0

                 NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                     1       0       0   0.000   0.000   0.000     -1.

STORAGE=        0.       50.      475.      900.     2135.     3080.     6300.       0.        0.        0.
OUTFLOW=        0.      200.     1020.     2050.     6100.    10250.    24000.       0.        0.        0.

                              STATION    2030, PLAN 1, RTIO 1
```

Exhibit 6
10 of 15

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STATION 2030, PLAN 2, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20603.	19364.	11267.	5087.	305199.
CMS	583.	548.	319.	144.	8642.
INCHES		5.13	11.94	13.48	13.48
MM		130.35	303.38	342.41	342.41
AC-FT		9607.	22359.	25236.	25236.
THOUS CU M		11850.	27580.	31128.	31128.

MAXIMUM STORAGE = 5505.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IAOST	ADSCNT	AANCST	ILPR
2030	16	1	0	0.	0.000	0	0.00000	0.00000	3

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.400	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6480.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.99	.99
3	1940.	3.097	1.776	5.81	5.81
4	2921.	1.769	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.06	.06
		AVG ANN DMG		33.58	33.58

LOCAL PROTECTION DATA

XLPMX	XLPMN	XANCST	XOSCNT
8300.	1700.	.02300	.05040

CAPACITY=	1700.	5000.	5500.	7000.	8300.	9500.	0.	0.	0.	0.
COST=	42.	103.	149.	222.	283.	340.	0.	0.	0.	0.

MINIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY DAMAGES
1030.	0.00
1130.	0.00
1380.	1.60
1740.	2.40
2280.	5.00
3200.	7.20
4220.	9.80
4800.	11.80
5620.	13.90
6480.	16.80
7340.	20.30
8540.	23.10
10000.	28.00
12100.	34.50
15100.	44.30
21000.	50.10

MAXIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY DAMAGES
1030.	0.00
1130.	0.00
1380.	1.60
1740.	2.40
2280.	5.00
3200.	7.20
4220.	9.80
4800.	11.80
5620.	13.90
6480.	16.80
7340.	20.30
8540.	23.10
10000.	28.00
12100.	34.50
15100.	44.30
21000.	50.10

INTERPOLATED ECONOMIC DATA FOR STATION 2030 PLAN 2

PEAK	SUM	TYPE 1
1030.	0.000	0.000
1130.	0.000	0.000
1380.	0.000	0.000
1740.	0.000	0.000
2280.	0.000	0.000
3200.	0.000	0.000
4980.	0.000	0.000
4985.	12.275	12.275
5620.	13.900	13.900
6480.	16.800	16.800
7340.	20.300	20.300
8540.	23.100	23.100
10000.	28.000	28.000
12100.	34.500	34.500
15100.	44.300	44.300
21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	941.	6.000	.284	0.00	0.00
2	1139.	5.452	1.752	0.00	0.00
3	1940.	3.097	1.776	0.00	0.00
4	2921.	1.769	1.072	0.00	0.00
5	4312.	.867	.785	2.13	2.13
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
	AVG ANN DMG			14.52	14.52
	AVG ANN BFT			19.06	19.06

LOCAL PROTECTION CAP COST = .103, TOTAL ANNUAL = 8. DESIGN Q = 4985.

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EXHIBIT 7

SIZING RESERVOIR, PUMPING PLANT, DIVERSION AND UNIFORM PROTECTION LOCAL PROJECTS

(Unconstrained)

```
A          FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
R-A        SIZING RESERVOIR, PUMPING PLANT, DIVERSION AND UNIFORM PROTECTION
R-A        LOCAL PROJECTS (LEVEE AND CHANNEL MODIFICATION)    UNCONSTRAINED
B        60        1                                                          3
I         6
J         2        9        1
I      0.25     0.30     0.50     0.70     1.00     1.50     2.20     3.25     4.40
R-2   -4000     -200                                        -500             -1000
8
K         0       10                                           1
I          POTENTIAL RESERVOIR INFLOW
M        -1              35.1                                                   1
N        74       24       26       33       50       85      190      375      515      590
N       660      710      760      800      840      910     1040     1290     1920     3000
N      3950     4600     5080     5360     5370     5100     4600     3980     3330     2720
N      2200     1840     1540     1250      995      775      605      470      365      280
N       215      160      120       95       77       66       59       53       49       42
N        40       38       35       33       30       30       29       27       25       25
K         1      110                                  2        1
I          PROPOSED RESERVOIR
Y                                  -1        0
Y                                   1        0        1
S         1                                                   -1
S     25000        0      200    975.0       .5    100.0     .023    .0504
1         0     2500     4000     5200     6800     9000    11500    15500    21000    30000
2       965     1000     1015     1030     1045     1060     1075     1090     1105     1120
3         0     1500     2400     3000     3600     4350     4950     5550     6000     7200
K         1     1030        1                                  1
I          POTENTIAL CHANNEL MODIFICATION REACH
Y                                   1        1                                   0
1         1                                                   -1
2         0       50      475      940     2135     3080     6300
3         0      200     1020     2050     6100    10250    24000
R-Z    1030       16        3        0                                                   (-2)
1         6      5.5      4.5      3.5      2.5      1.5       .9       .7       .5      .35
1       .25      .15      .10      .05      .02     .005
2      1030     1150     1380     1740     2280     3200     4220     4800     5620     6480
2      7340     8540    10000    12100    15100    21000
3
4         0        0       .1       .2       .3       .3       .4       .5       .6       .7
4        .8       .9      1.0      1.2      1.5      1.8
4         0        0       .5       .7      1.5      2.2      2.9      3.5      4.0      4.7
4       5.8      6.6      8.0     10.3     15.0     18.1
4         0        0      1.0      1.5      3.2      4.7      6.5      7.8      9.3     11.0
4      13.7     15.6     19.0     23.0     27.8     30.2
/      8300     1700     .023    .0504
1      1700     5000     5500     7000     8300     9300
2        42      103      149      222      283      340
3      1030     1130     1380     1740     2280     3200     4220     4800     5620     6480
3      7340     8540    10000    12100    15100    21000
4         0        0        0      .01      .14      .25      .36      .43      .53      .62
4       .69      .82      .97     1.17     1.43     1.76
4         0        0        0      .08      .95     1.73     2.53     2.73     3.53     4.08
4      5.01     6.16     7.70     9.90    14.08    17.51
```

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

4	0	0	0	.13	1.73	3.44	5.85	7.23	8.91	10.63
4	13.11	15.03	18.61	22.09	27.00	29.32				
5	0	0	0	0	0	0	0	0	0	0
5	0	.04	.25	.42	.64	.99				
5	0	0	0	0	0	0	0	0	0	0
5	0	.25	1.75	3.18	5.04	7.98				
5	0	0	0	0	0	0	0	0	0	0
5	0	.44	3.50	7.15	12.29	16.86				
K	0	20								
N	-1		35.1						1	
N	24	24	26	33	50	85	190	375	515	590
N	660	710	760	800	840	910	1040	1290	1920	3000
N	3950	4600	5080	5360	5370	5100	4600	3980	3330	2720
N	2200	1840	1540	1250	995	775	605	470	365	280
N	215	140	120	95	77	66	59	53	49	42
N	40	38	35	33	30	30	29	27	25	25
K	1	20				2	1			
1	DUMMY RESERVOIR TO ACCOMODATE DIVERSION									
Y				-1	0					
Y				1	0			7		
1	1						-1			
2	0	2000								
3	0	100000								
4	20000	0	1500	.015	.0504					
1	0	1250	2500	3750	5000	7500	10000	15000	20000	
2	0	1500	2600	3400	4200	5200	6100	7500	8300	
K	1	2030	1				1			
1	POTENTIAL LEVEE AND/OR BYPASS REACH									
Y				1	1				0	
1	1						-1			
2	0	50	475	940	2135	3080	8300			
3	0	200	1020	2050	6100	10250	24000			
Z	2030	16	1	0						-2
1	6	5.5	4.5	3.5	2.5	1.5	.9	.7	.5	.35
1	.25	.15	.10	.05	.02	.005				
2	1030	1130	1380	1740	2280	3200	4220	4800	5620	6480
2	7340	8540	10000	12100	15100	21000				
3										
4	0	0	1.6	2.4	5.0	7.2	9.8	11.8	13.9	16.4
4	20.3	23.1	28.0	34.5	44.3	50.1				
/	8300	1700	.023	.0504						
1	1700	5000	5500	7000	8300	9300				
2	42	103	149	222	283	340				
3	1030	1130	1380	1740	2280	3200	4220	4800	5620	6480
3	7340	8540	10000	12100	15100	21000				
4	0	0	1.6	2.4	5.0	7.2	9.8	11.8	13.9	16.4
4	20.3	23.1	28.0	34.5	44.3	50.1				
5	0	0	1.6	2.4	5.0	7.2	9.8	11.8	13.9	16.4
5	20.3	23.1	28.0	34.5	44.3	50.1				
K	0	30					1			
1	LOCAL INFLOW TO FOREBAY POOL									
N	-1		10.0						1	
N	8	8	9	11	17	28	63	125	170	195
N	220	230	255	265	280	305	350	430	640	1000
N	1320	1540	1650	1800	1810	1690	1530	1330	1110	900
N	730	615	515	415	330	255	200	155	120	93
N	72	54	41	32	26	22	20	18	16	14
N	13	12	11	11	11	10	10	9	9	9
K	3	30					1			
1	COMBINED INFLOW TO FOREBAY POOL									

<u>LEGEND</u>

N = NEW INPUT DATA

R = REVISED INPUT DATA

( ) = REVISED INPUT DATA

K	1	305	1			2	1			
I	PROPOSED PUMPING PLANT SITE								1	
V				1	0		-1			
1	1									
2	0	400	100000							
3	0	1200	1200				9		1	
V				1	0		-1			
1	1									
2	0	400	100000							
3	0	1200	1200							
0	10000	0	1500	100	.023	.0504				
1	0	250	500	1000	2000	6000	8000	10000		
2	0	670	1000	1600	2300	6000	7060	6670		
Z	.305	10	2	1	.10	.05	.02	.01	.005	.002
1	.70	.00	.45	.25						
2	1500	2300	8000	7000	12500	20000	28000	37000	50000	76000
3										
0	0	37.5	75.	1125	3150	5050	7050	9000	10650	11250
0	0	10.5	15	52.5	105	202.5	300	390	540	585
K	99									
A										
A										
A										
A										
A										

LEGEND

N = NEW INPUT DATA

R = REVISED INPUT DATA

○ = REVISED INPUT DATA

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FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION
SIZING RESERVOIR, PUMPING PLANT, DIVERSION AND UNIFORM PROTECTION
LOCAL PROJECTS(LEVEE AND CHANNEL MODIFICATION)    UNCONSTRAINED

                    JOB SPECIFICATION
   NQ   NHR  NMIN  IDAY   IHR  IMIN METRC  IPLT  IPNT NSTAN
   60     1     0     0     0     0     0     0     3     0
                    JOPER   NWT LROPT TRACE
                        6     0     0     0

              MULTI-PLAN ANALYSES TO BE PERFORMED
                 NPLAN= 2 NRTIO= 9 LRTIO= 1
 RTIOS=    .25    .30    .50    .70   1.00   1.50   2.20   3.25   4.40

                                 SYSTEM OPTIMIZATION
   VAR 1     VAR 2     VAR 3     VAR 4     VAR 5     VAR 6     DIV 7     DIV 8     PMP 9    PMP 10
  -4000.     -200.       0.        0.        0.        0.      -500.       0.     -1000.       0.

                           FIXED COST INPUT
                          FCAP    FOCNT      FAN
                            0.   0.0000   0.0000
                            0.       0.       0.

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          1030      6015.571         0.000        0.000         0.000

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          2030      7808.356         0.000        0.000         0.000

                  NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                   1  1  1  .400E+04  .400E+04    0.000   464.697   600.578 .107E+04

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          1030      6054.577         0.000        0.000         0.000

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          2030      7808.356         0.000        0.000         0.000

                  NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                   2  1  1  .396E+04  .396E+04    0.000   463.166   602.957 .107E+04

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          1030      6099.605         0.000        0.000         0.000

                          ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                          2030      7808.356         0.000        0.000         0.000

                  NC  M M1   VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                   3  1  1  .392E+04  .392E+04    0.000   461.657   605.347 .107E+04

OBJECTIVE FUNCTION FOR VARIABLE 1      .1065E+04      .1066E+04      .1067E+04
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Exhibit 7
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                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4615,376        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7808,356        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          1   2  1  ,200E+03  ,519E+04     0,000    500,189    540,857  ,105E+04
VAR  1 ADJ FROM        4000,00 TO        5190,33

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4646,889        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7839,689        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          2   2  1  ,198E+03  ,519E+04     0,000    500,340    540,643  ,105E+04

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4678,017        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7871,148        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          3   2  1  ,196E+03  ,519E+04     0,000    500,491    540,624  ,105E+04
OBJECTIVE FUNCTION FOR VARIABLE 2      ,1049E+04     ,1049E+04     ,1049E+04
                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4641,270        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7834,109        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          1   7  2  ,500E+03  ,198E+03     0,000    500,313    540,647  ,105E+04
VAR  2 ADJ FROM         200,00 TO         198,36

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4641,270        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7839,954        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          2   7  2  ,495E+03  ,198E+03     0,000    499,969    549,098  ,105E+04

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              1030      4641,270        0,000         0,000         0,000

                                                              ISTA      INT FLOW     TRG FLOW       FLW OBJ       FLW DEV
                                                              2030      7845,800        0,000         0,000         0,000

                                                         NC   M M1    VAR(M)    VAR(M1)   OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                          3   7  2  ,490E+03  ,198E+03     0,000    499,626    549,541  ,105E+04
OBJECTIVE FUNCTION FOR VARIABLE 7      ,1049E+04     ,1049E+04     ,1049E+04
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                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4641,270       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M) . VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 1   9  7  ,100E+04  ,750E+03    0,000    517,659    527,738 ,105E+04
VAR  7 ADJ FROM        500,00 TO        750,00

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4641,270       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 2   9  7  ,990E+03  ,750E+03    0,000    516,779    528,959 ,105E+04

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4641,270       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 3   9  7  ,980E+03  ,750E+03    0,000    515,898    530,182 ,105E+04
OBJECTIVE FUNCTION FOR VARIABLE 9     ,1045E+04      ,1046E+04       ,1046E+04

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4641,270       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 1   1  9  ,519E+04  ,150E+04    0,000    543,349    474,233 ,102E+04
VAR  9 ADJ FROM       1000,00 TO       1500,00

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4698,502       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 2   1  9  ,514E+04  ,150E+04    0,000    541,629    476,321 ,102E+04

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     1030      4758,866       0,000         0,000        0,000

                                                     ISTA      INT FLOW     TRG FLOW       FLW OBJ      FLW DEV
                                                     2030      7578,270       0,000         0,000        0,000

                                                NC   M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 3   1  9  ,509E+04  ,150E+04    0,000    539,912    478,401 ,102E+04
OBJECTIVE FUNCTION FOR VARIABLE 1     ,1018E+04      ,1018E+04       ,1018E+04
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                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2576.749           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7578.270           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        1  2  1  .198E+03  .779E+04      0.000    604.746    401.783  .101E+04
VAR  1 ADJ FROM        5190.33 TO        7785.49

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2599.856           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7609.217           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        2  2  1  .196E+03  .779E+04      0.000    604.881    401.712  .101E+04

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2621.135           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7640.290           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        3  2  1  .194E+03  .779E+04      0.000    605.017    401.700  .101E+04
OBJECTIVE FUNCTION FOR VARIABLE 2      .1007E+04      .1007E+04        .1007E+04
                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2566.451           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7560.181           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        1  7  2  .750E+03  .200E+03      0.000    604.667    401.932  .101E+04

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2575.053           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7572.839           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        1  7  2  .750E+03  .199E+03      0.000    604.722    401.921  .101E+04

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2577.640           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7576.641           0.000            0.000            0.000

                                                       NC  M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                        1  7  2  .750E+03  .198E+03      0.000    604.739    401.828  .101E+04

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          1030        2578.749           0.000            0.000            0.000

                                                          ISTA        INT FLOW        TRG FLOW          FLW OBJ          FLW DEV
                                                          2030        7578.270           0.000            0.000            0.000
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                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  7  2  .750E+03  .198E+03     0.000    604.746   401.783  .101E+04

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              1030        2578.749          0.000            0.000           0.000

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              2030        7585.949          0.000            0.000           0.000

                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  7  2  .743E+03  .198E+03     0.000    604.224   402.348  .101E+04

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              1030        2578.749          0.000            0.000           0.000

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              2030        7593.627          0.000            0.000           0.000

                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  7  2  .735E+03  .198E+03     0.000    603.703   402.920  .101E+04

OBJECTIVE FUNCTION FOR VARIABLE 7      .1007E+04      .1007E+04      .1007E+04

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              1030        2578.749          0.000            0.000           0.000

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              2030        7531.575          0.000            0.000           0.000

                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           1  9  7  .150E+04  .796E+03     0.000    607.922   398.339  .101E+04
VAR  7 ADJ FROM        750.00 TO        795.60

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              1030        2578.749          0.000            0.000           0.000

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              2030        7531.575          0.000            0.000           0.000

                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           2  9  7  .149E+04  .796E+03     0.000    607.151   399.764  .101E+04

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              1030        2578.749          0.000            0.000           0.000

                                                              ISTA        INT FLOW        TRG FLOW          FLW OBJ         FLW DEV
                                                              2030        7531.575          0.000            0.000           0.000

                                                          NC  M M1    VAR(M)   VAR(M1)    OBJ DEV    TANCST      ANDMG O FTN(NC)
                                                           3  9  7  .147E+04  .796E+03     0.000    606.381   401.193  .101E+04

OBJECTIVE FUNCTION FOR VARIABLE 9      .1006E+04      .1007E+04      .1008E+04
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Exhibit 7
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                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2578,749       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7531,575       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               1  1  9  ,779E+04  ,225E+04    0,000   650,506   336,824  ,987E+03
VAR  9 ADJ FROM        1500,00 TO        2250,00

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2606,145       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7531,575       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               2  1  9  ,771E+04  ,225E+04    0,000   648,803   338,191  ,987E+03

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2631,587       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7531,575       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               3  1  9  ,763E+04  ,225E+04    0,000   647,015   339,542  ,987E+03
OBJECTIVE FUNCTION FOR VARIABLE 1      ,9874E+03      ,9870E+03      ,9866E+03

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      4641,267       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7531,575       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               1  2  1  ,198E+03  ,519E+04    0,000   589,190   406,932  ,996E+03

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2846,968       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7531,575       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               1  2  1  ,198E+03  ,701E+04    0,000   632,730   350,530  ,983E+03
VAR  1 ADJ FROM        7785,49 TO        7006,94

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2874,189       0,000        0,000         0,000

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 2030      7562,481       0,000        0,000         0,000

                                                              NC  M M1    VAR(M)   VAR(M1)  OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                               2  2  1  ,196E+03  ,701E+04    0,000   632,874   350,434  ,983E+03

                                                                 ISTA      INT FLOW     TRG FLOW      FLW OBJ       FLW DEV
                                                                 1030      2901,670       0,000        0,000         0,000
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                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7593.514         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        3  2  1   .194E+03  .701E+04     0.000     633.018    350.417  .983E+03
OBJECTIVE FUNCTION FOR VARIABLE 2      .9833E+03       .9833E+03        .9834E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2844.594         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7528.872         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        1  7  2   .796E+03  .199E+03     0.000     632.718    350.602  .983E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2846.256         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7530.764         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        1  7  2   .796E+03  .198E+03     0.000     632.726    350.553  .983E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2846.754         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7531.332         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        1  7  2   .796E+03  .198E+03     0.000     632.729    350.537  .983E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2846.968         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7531.575         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        1  7  2   .796E+03  .198E+03     0.000     632.730    350.530  .983E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2846.968         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7539.649         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        2  7  2   .788E+03  .198E+03     0.000     632.176    351.059  .983E+03

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            1030        2846.968         0.000          0.000          0.000

                                                            ISTA        INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                            2030        7547.796         0.000          0.000          0.000

                                                       NC  M M1     VAR(M)   VAR(M1)   OBJ DEV      TANCST     ANDMG O FTN(NC)
                                                        3  7  2   .780E+03  .198E+03     0.000     631.623    351.596  .983E+03
OBJECTIVE FUNCTION FOR VARIABLE 7      .9833E+03       .9832E+03        .9832E+03
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                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
VAR  7 ADJ FROM       795.68 TO       769.45     1   9  7  .225E+04  .769E+03    0.000    630.906   352.292  .983E+03

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 2   9  7  .223E+04  .769E+03    0.000    629.378   353.881  .983E+03

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 3   9  7  .221E+04  .769E+03    0.000    627.850   355.468  .983E+03
OBJECTIVE FUNCTION FOR VARIABLE 9    .9832E+03    .9833E+03    .9833E+03

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 1   1  9  .701E+04  .338E+04    0.000    707.288   287.788  .995E+03

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
                                                 1   1  9  .701E+04  .259E+04    0.000    653.820   330.730  .985E+03

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      1030      2846.968        0.000         0.000         0.000

                                                      ISTA      INT FLOW      TRG FLOW      FLW OBJ       FLW DEV
                                                      2030      7558.355        0.000         0.000         0.000

                                                 NC  M M1    VAR(M)   VAR(M1)   OBJ DEV    TANCST     ANDMG O FTN(NC)
VAR  9 ADJ FROM      2250.00 TO      2351.25     1   1  9  .701E+04  .235E+04    0.000    637.780   345.312  .983E+03
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                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      2871.174        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7558.355        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
                                                              2   1  9   .694E+04  .235E+04    0.000     634.174    346.555  .983E+03

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      2893.548        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7558.355        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
                                                              3   1  9   .687E+04  .235E+04    0.000     634.567    347.813  .982E+03

OBJECTIVE FUNCTION FOR VARIABLE 1      .9831E+03       .9827E+03        .9824E+03

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      4836.753        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7558.355        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
                                                              1   2  1   .198E+03  .503E+04    0.000     588.787    407.956  .997E+03

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      3177.182        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7558.355        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
VAR  1 ADJ FROM         7006.94 TO        6812.47             1   2  1   .198E+03  .641E+04    0.000     623.850    358.293  .982E+03

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      3208.106        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7589.284        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
                                                              2   2  1   .196E+03  .641E+04    0.000     623.598    358.206  .982E+03

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  1030      3239.330        0.000          0.000          0.000

                                                                  ISTA      INT FLOW      TRG FLOW        FLW OBJ        FLW DEV
                                                                  2030      7620.339        0.000          0.000          0.000

                                                             NC   M M1    VAR(M)   VAR(M1)    OBJ DEV     TANCST      ANDMG  O FTN(NC)
                                                              3   2  1   .194E+03  .641E+04    0.000     623.748    358.187  .982E+03

OBJECTIVE FUNCTION FOR VARIABLE 2      .9817E+03       .9818E+03        .9819E+03
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         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3165.333          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7546.458          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  1    7  2  .769E+03  .199E+03      0.000    623.393    358.432 .982E+03

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3173.623          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7554.784          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  1    7  2  .769E+03  .199E+03      0.000    623.433    358.384 .982E+03

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3176.114          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7557.284          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  1    7  2  .769E+03  .198E+03      0.000    623.445    358.320 .982E+03

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3177.182          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7558.355          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  1    7  2  .769E+03  .198E+03      0.000    623.450    358.293 .982E+03

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3177.182          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7566.234          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  2    7  2  .762E+03  .198E+03      0.000    622.915    358.821 .982E+03

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         1030        3177.182          0.000          0.000          0.000

         ISTA        INT FLOW       TRG FLOW        FLW OBJ        FLW DEV
         2030        7574.112          0.000          0.000          0.000

 NC    M M1     VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
  3    7  2  .754E+03  .198E+03      0.000    622.380    359.350 .982E+03

OBJECTIVE FUNCTION FOR VARIABLE 7      .9817E+03      .9817E+03      .9817E+03
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                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         1   9  7  .235E+04  .670E+03     0.000    616.535    366.679  .981E+03
VAR  7 ADJ FROM         769.45 TO         669.92

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         2   9  7  .233E+04  .670E+03     0.000    614.938    366.326  .981E+03

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         3   9  7  .230E+04  .670E+03     0.000    613.342    367.972  .981E+03
OBJECTIVE FUNCTION FOR VARIABLE 9      .9812E+03       .9813E+03       .9813E+03

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         1   1  9  .641E+04  .353E+04     0.000    696.354    296.653  .993E+03

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         1   1  9  .641E+04  .270E+04     0.000    640.481    341.930  .982E+03

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              1030      3177.182        0.000          0.000         0.000

                                                              ISTA      INT FLOW     TRG FLOW        FLW OBJ       FLW DEV
                                                              2030      7660.243        0.000          0.000         0.000

                                                         NC   M M1    VAR(M)   VAR(M1)   OBJ DEV     TANCST     ANDMG O FTN(NC)
                                                         1   1  9  .641E+04  .246E+04     0.000    623.719    357.326  .981E+03
VAR  9 ADJ FROM        2351.25 TO        2457.06
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                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      3177.182        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      1   1  1  .641E+04  .641E+04      0.000     623.719    357.326  .981E+03

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      3249.430        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      2   1  1  .635E+04  .635E+04      0.000     622.184    359.276  .981E+03

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      3323.478        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      3   1  1  .628E+04  .628E+04      0.000     620.651    361.229  .982E+03
OBJECTIVE FUNCTION FOR VARIABLE 1      .9810E+03      .9815E+03      .9819E+03
                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      1822.015        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      1   2  1  .198E+03  .962E+04      0.000     693.019    299.569  .993E+03

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      2719.713        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      1   2  1  .198E+03  .737E+04      0.000     646.474    338.056  .985E+03

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            1030      2946.830        0.000        0.000        0.000

                                                            ISTA      INT FLOW      TRG FLOW      FLW OBJ      FLW DEV
                                                            2030      7660.243        0.000        0.000        0.000

                                                     NC   M M1    VAR(M)    VAR(M1)    OBJ DEV     TANCST      ANDMG O FTN(NC)
                                                      1   2  1  .198E+03  .670E+04      0.000     630.790    350.087  .981E+03
VAR  1 ADJ FROM      6412.47 TO      6701.03
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**********          **********          **********          **********          **********

                              SUB-AREA RUNOFF COMPUTATION

          POTENTIAL RESERVOIR INFLOW
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       10       0       0       2       0       0       1       0       0

                          PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
                                          PLAN 1,RATIO 1
       6.        6.        7.        8.       13.       21.       40.       94.      129.      100.
     165.      178.      190.      200.      210.      228.      260.      323.      480.      790.
     987.     1150.     1270.     1340.     1343.     1275.     1150.      995.      833.      600.
     550.      460.      385.      313.      249.      194.      151.      118.       91.       70.
      54.       40.       30.       24.       19.       17.       15.       13.       12.       11.
      10.       10.        9.        8.        8.        8.        7.        7.        6.        6.


**********          **********          **********          **********          **********

                                    HYDROGRAPH ROUTING

          PROPOSED RESERVOIR
                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                      110       1       0       0       0       2       1       0       0

                                          PLAN 1
                                       ROUTING DATA
          QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
            0.0   0.000    0.00      -1       0       0       0       0       0

                                          PLAN 2
                                       ROUTING DATA
          QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
            0.0   0.000    0.00       1       0       1       0       0       0

                    NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                        1       0       0   0.000   0.000   0.000     -1.

                                      RESERVOIR DATA
     CAPMX    CAPMN     COOL   ELEVL     EXPL    COOW  RANCST  RDSCNT    COOT   ELEVT    EXPT
    25000.       0.   200.00  975.00      .50  100.00   .0230   .0504    0.00  975.00    0.00

  CAPACITY=        0.     2500.     4000.     5200.     6800.     9000.    11500.    15500.    21000.    30000.
 ELEVATION=      965.     1000.     1015.     1030.     1045.     1060.     1075.     1090.     1105.     1120.
      COST=        0.     1500.     2400.     3000.     3600.     4350.     4950.     5550.     6000.     7200.

OUTLET CREST ELEVATION IS 1044.07 AT STORAGE OF      6701.

                                 SYNTHETIC STORAGE OUTFLOW FUNCTION
   STORAGE=      714.     1023.     1948.     3885.     6701.    10674.    14247.    18469.    23711.    30000.
   OUTFLOW=        0.      416.      831.     1247.     1662.    15102.    28565.    41916.    55248.    68569.

                              STATION     110, PLAN 2, RTIO 1
```

Exhibit 7
16 of 39

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STATION 110, PLAN 2, RTIO 9

RESERVOIR	CAP COST	TOT ANN $
6701.0	3563.	262.

OUTFLOW

106.	106.	106.	109.	116.	135.	185.	297.	435.	508.
589.	678.	771.	849.	897.	949.	1008.	1080.	1185.	1321.
1491.	2442.	7091.	11005.	14112.	16411.	17732.	18039.	17514.	16387.
14919.	13432.	11953.	10519.	9144.	7849.	6662.	5603.	4674.	3872.
3185.	2603.	2113.	1709.	1648.	1632.	1616.	1599.	1582.	1566.
1549.	1532.	1516.	1499.	1483.	1466.	1450.	1434.	1418.	1402.

STOR

793.	793.	793.	795.	801.	815.	852.	934.	1066.	1228.
1410.	1607.	1814.	2031.	2257.	2499.	2772.	3110.	3600.	4391.
5538.	6930.	8296.	9447.	10360.	11002.	11355.	11437.	11297.	10996.
10597.	10160.	9725.	9304.	8899.	8519.	8170.	7859.	7586.	7350.
7149.	6978.	6834.	6715.	6607.	6498.	6386.	6274.	6161.	6047.
5934.	5820.	5708.	5596.	5484.	5373.	5263.	5154.	5046.	4938.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	18039.	16834.	9192.	4271.	256284.
CMS	511.	477.	260.	121.	7257.
INCHES		4.46	9.74	11.32	11.32
MM		113.32	247.52	287.53	287.53
AC-FT		8352.	18242.	21191.	21191.
THOUS CU M		10302.	22502.	26139.	26139.

MAXIMUM STORAGE = 11437.

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HYDROGRAPH ROUTING

POTENTIAL CHANNEL MODIFICATION REACH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1030	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	50.	475.	940.	2135.	3080.	6300.	0.	0.	0.
OUTFLOW=	0.	200.	1020.	2050.	6100.	10250.	24000.	0.	0.	0.

STATION 1030, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	941.	907.	613.	269.	17369.
CMS	27.	26.	17.	8.	492.
INCHES		.24	.65	.77	.77
MM		6.10	16.51	19.49	19.49
AC-FT		450.	1217.	1436.	1436.
THOUS CU M		555.	1501.	1772.	1772.

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EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	IBANE	TRGT	DGPNT	IABST	ADBCNT	AANCST	ILPR
1030	16	3	0	0.	0.000	0	0.00000	0.00000	-2

ECONOMIC DATA FOR STATION 1030 PLAN 1

FREQ	PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
6.000	1030.	0.000	0.000	0.000	0.000
5.500	1130.	0.000	0.000	0.000	0.000
4.500	1380.	1.600	.100	.500	1.000
3.500	1740.	2.400	.200	.700	1.500
2.500	2280.	5.000	.300	1.500	3.200
1.500	3200.	7.200	.300	2.200	4.700
.900	4220.	9.800	.400	2.900	6.500
.700	4600.	11.800	.500	3.500	7.800
.500	5620.	13.900	.600	4.000	9.300
.350	6480.	16.400	.700	4.700	11.000
.250	7340.	20.300	.800	5.800	13.700
.150	8540.	23.100	.900	6.600	15.600
.100	10000.	28.000	1.000	8.000	19.000
.050	12100.	34.500	1.200	10.300	23.000
.020	15100.	44.300	1.500	15.000	27.000
.005	21000.	50.100	1.800	18.100	30.200

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	941.	6.000	.284	0.00	0.00	0.00	0.00
2	1139.	5.462	1.752	.99	.07	.30	.62
3	1980.	3.097	1.776	5.81	.40	1.73	3.68
4	2921.	1.769	1.072	6.66	.31	2.02	4.33
5	4312.	.867	.785	7.73	.33	2.28	5.12
6	6699.	.323	.391	6.54	.27	1.87	4.39
7	10191.	.095	.136	3.70	.14	1.08	2.48
8	15177.	.020	.037	1.50	.05	.50	.95
9	20003.	.006	.014	.66	.02	.24	.40
		AVG ANN DMG		33.58	1.59	10.02	21.97

LOCAL PROTECTION DATA

XLPMX	XLPMN	XANCST	XDBCNT
8300.	1700.	.02300	.05040

CAPACITY=	1700.	5000.	5500.	7000.	8300.	9300.	0.	0.	0.	0.
COST=	42.	103.	149.	222.	283.	340.	0.	0.	0.	0.

MINIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY	DAMAGES	
1030.	0.00	0.00	0.00
1130.	0.00	0.00	0.00
1380.	0.00	0.00	0.00
1740.	.01	.08	.13
2280.	.14	.95	1.73
3200.	.25	1.73	3.44
4220.	.36	2.53	5.85
4800.	.43	2.73	7.23
5620.	.53	3.53	8.91
6480.	.62	4.08	10.63
7340.	.69	5.01	13.11
8540.	.82	6.16	15.03
10000.	.97	7.70	18.61
12100.	1.17	9.90	22.09
15100.	1.43	14.08	27.00
21000.	1.76	17.51	29.32

MAXIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY	DAMAGES	
1030.	0.00	0.00	0.00
1130.	0.00	0.00	0.00
1380.	0.00	0.00	0.00
1740.	0.00	0.00	0.00
2280.	0.00	0.00	0.00
3200.	0.00	0.00	0.00
4220.	0.00	0.00	0.00
4800.	0.00	0.00	0.00
5620.	0.00	0.00	0.00
6480.	0.00	0.00	0.00
7340.	0.00	0.00	0.00
8540.	.08	.25	.44
10000.	.25	1.75	3.50
12100.	.42	3.18	7.15
15100.	.64	5.04	12.29
21000.	.99	7.98	16.86

INTERPOLATED ECONOMIC DATA FOR STATION 1030 PLAN 2

PEAK	SUM	TYPE 1	TYPE 2	TYPE 3
1030.	0.000	0.000	0.000	0.000
1130.	0.000	0.000	0.000	0.000
1380.	0.000	0.000	0.000	0.000
2044.	0.000	0.000	0.000	0.000
2947.	1.151	.089	.569	.493
3200.	1.867	.120	.784	.963
4220.	5.187	.230	1.584	3.373
4800.	6.837	.300	1.784	4.753
5620.	9.417	.400	2.584	6.433
6480.	11.777	.490	3.134	8.153
7340.	15.257	.560	4.064	10.633
8540.	17.990	.673	5.044	12.274
10000.	23.165	.834	6.576	15.756
12100.	28.926	1.028	8.631	19.268
15100.	37.874	1.281	12.372	24.221
21000.	44.290	1.615	15.710	26.966

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 1030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2	TYPE 3
1	525.	6.060	.284	0.00	0.00	0.00	0.00
2	594.	5.462	1.752	0.00	0.00	0.00	0.00
3	839.	3.047	1.776	0.00	0.00	0.00	0.00
4	1005.	1.769	1.072	0.00	0.00	0.00	0.00
5	1252.	.467	.765	0.00	0.00	0.00	0.00
6	1574.	.323	.391	.06	.00	.03	.03
7	4944.	.095	.136	1.02	.04	.28	.69
8	10079.	.020	.037	.80	.03	.23	.54
9	15363.	.006	.014	.49	.02	.16	.31
		AVG ANN DMG		2.37	.09	.70	1.58
		AVG ANN BFT		31.21	1.50	9.32	20.39

UNIFORM PROTECTION LEVEL = .198

LOCAL PROTECTION CAP COST = 65. TOTAL ANNUAL = 5. DESIGN Q = 2947.

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
20	0	0	2	0	0	0	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE

PLAN 1, RATIO 1

6.	6.	7.	8.	13.	21.	48.	94.	129.	148.
165.	176.	190.	200.	210.	228.	260.	323.	480.	750.
987.	1150.	1270.	1340.	1343.	1275.	1150.	995.	833.	680.
550.	460.	385.	313.	249.	194.	151.	118.	91.	70.
54.	40.	30.	24.	19.	17.	15.	13.	12.	11.
10.	10.	9.	8.	8.	8.	7.	7.	6.	6.

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HYDROGRAPH ROUTING

DUMMY RESERVOIR TO ACCOMODATE DIVERSION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
20	1	0	0	0	2	1	0	0

PLAN 1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IOVR	LSTR
0.0	0.000	0.00	-1	0	0	0	0	0

PLAN 2
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	0	7	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	2000.	0.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	100000.	0.	0.	0.	0.	0.	0.	0.	0.

DIVERSION DATA

DVRMX	DVRMN	THDVR	DANCST	DDSCNT
20000.	0.	1500.	.01500	.05040

CAPACITY=	0.	1250.	2500.	3750.	5000.	7500.	10000.	15000.	20000.	0.
COST=	0.	1500.	2600.	3400.	4200.	5200.	6100.	7500.	8300.	0.

STATION 20, PLAN 2, RTIO 1

OUTFLOW

6.	6.	6.	8.	11.	19.	40.	81.	122.	144.
161.	175.	187.	198.	207.	223.	251.	305.	435.	678.
935.	1115.	1243.	1327.	1346.	1296.	1184.	1034.	872.	716.
580.	479.	403.	330.	263.	207.	161.	125.	97.	75.
57.	43.	32.	25.	20.	17.	15.	14.	12.	11.
10.	10.	9.	8.	8.	7.	7.	7.	6.	6.

STOR

0.	0.	0.	0.	0.	0.	1.	2.	2.	3.
3.	3.	4.	4.	4.	4.	5.	6.	9.	14.
19.	22.	25.	27.	27.	26.	24.	21.	17.	14.
12.	10.	8.	7.	5.	4.	3.	3.	2.	1.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1346.	1252.	659.	290.	17375.
CMS	38.	35.	19.	8.	492.
INCHES		.33	.70	.77	.77
MM		8.[illegible]	17.74	19.49	19.49
AC-FT		621.	1307.	1437.	1437.
THOUS CU M		766.	1613.	1772.	1772.

MAXIMUM STORAGE = 27.

Exhibit
23 of [illegible]

AD-A106 702 HYDROLOGIC ENGINEERING CENTER DAVIS CA F/G 8/8
FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY. R--ETC(U)
SEP 77
UNCLASSIFIED HEC-TD-9-REV NL

3 of 3

END
DATE
FILMED
12
DTIC

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STATION 20, PLAN 2, RTIO 9

DIVERSION CAP COST TOT ANN $
669.9 804. 53.

OUTFLOW

106.	106.	112.	136.	199.	331.	700.	1432.	1230.	1943.
2128.	2419.	2614.	2813.	2981.	3249.	3749.	4702.	6980.	11258.
15789.	18958.	21206.	22678.	23026.	22134.	20161.	17526.	14677.	11932.
9536.	7760.	6421.	5137.	3967.	2966.	2158.	1672.	1752.	1303.
1014.	759.	566.	441.	357.	300.	266.	239.	219.	194.
176.	170.	157.	147.	136.	131.	129.	121.	112.	109.

STOR

2.	2.	2.	3.	4.	7.	14.	29.	25.	39.
43.	48.	52.	56.	60.	65.	75.	94.	140.	225.
316.	379.	424.	454.	461.	443.	403.	351.	294.	239.
191.	155.	128.	103.	79.	59.	43.	33.	35.	26.
20.	15.	11.	9.	7.	6.	5.	5.	4.	4.
4.	3.	3.	3.	3.	3.	3.	2.	2.	2.

DIVERSION

0.	0.	0.	0.	0.	0.	0.	0.	670.	670.
670.	670.	670.	670.	670.	670.	670.	670.	670.	670.
670.	670.	670.	670.	670.	670.	670.	670.	670.	670.
670.	670.	670.	670.	670.	670.	670.	568.	106.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	23026.	21360.	10926.	4762.	285697.
CMS	652.	605.	309.	135.	8090.
INCHES		5.66	11.58	12.62	12.62
MM		143.79	294.19	320.53	320.53
AC-FT		10597.	21682.	23624.	23624.
THOUS CU M		13072.	26745.	29139.	29139.

MAXIMUM STORAGE = 461.

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**********          **********          **********          **********          **********

                                   HYDROGRAPH ROUTING

                 POTENTIAL LEVEE AND/OR BYPASS REACH
                     ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                      2030       1       1       0       0       0       1       0       0

                                  ALL PLANS HAVE SAME
                                     ROUTING DATA
              QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IOVR    LSTR
                0.0   0.000    0.00       1       1       0       0       0       0

                      NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                          1       0       0   0.000   0.000   0.000     -1.

STORAGE=        0.        50.      475.      940.     2135.     3080.     6300.        0.        0.        0.
OUTFLOW=        0.       200.     1020.     2050.     6100.    10250.    24000.        0.        0.        0.

                            STATION     2030, PLAN 1, RTIO 1

                        PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
             CFS        941.      907.       613.       289.         17369.
             CMS         27.       26.        17.         8.           492.
          INCHES                   .24        .65        .77            .77
              MM                  6.10      16.51      19.49          19.49
           AC-FT                  450.      1217.      1436.          1436.
       THOUS CU M                 555.      1501.      1772.          1772.


                            MAXIMUM STORAGE =        434.

                            STATION     2030, PLAN 1, RTIO 2

                        PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
             CFS       1139.     1091.       733.       347.         20842.
             CMS         32.       31.        21.        10.           590.
          INCHES                   .29        .78        .92            .92
              MM                  7.34      19.73      23.38          23.38
           AC-FT                  541.      1454.      1723.          1723.
       THOUS CU M                 668.      1794.      2126.          2126.


                            MAXIMUM STORAGE =        529.

                            STATION     2030, PLAN 1, RTIO 3

                        PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
             CFS       1980.     1859.      1220.       579.         34733.
             CMS         55.       53.        35.        16.           984.
          INCHES                   .49       1.29       1.53           1.53
              MM                 12.52      32.84      38.97          38.97
           AC-FT                  922.      2420.      2872.          2872.
       THOUS CU M                1138.      2985.      3543.          3543.


                            MAXIMUM STORAGE =        890.
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EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	DGPRT	IAGST	ADSCNT	AANCST	ILPR
2030	16	1	0	0.	0.000	0	0.00000	0.00000	-2

ECONOMIC DATA FOR STATION 2030 PLAN 1

FREQ	PEAK	SUM	TYPE 1
6.000	1030.	0.000	0.000
5.500	1130.	0.000	0.000
4.500	1380.	1.600	1.600
3.500	1740.	2.400	2.400
2.500	2280.	5.000	5.000
1.500	3200.	7.200	7.200
.900	4220.	9.800	9.800
.700	4800.	11.800	11.800
.500	5620.	13.900	13.900
.350	6480.	16.400	16.400
.250	7340.	20.300	20.300
.150	8540.	23.100	23.100
.100	10000.	28.000	28.000
.050	12100.	34.500	34.500
.020	15100.	44.300	44.300
.005	21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 1

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	981.	6.000	.284	0.00	0.00
2	1139.	5.462	1.752	.99	.99
3	1940.	3.097	1.776	5.81	5.81
4	2921.	1.709	1.072	6.66	6.66
5	4312.	.867	.785	7.73	7.73
6	6699.	.323	.391	6.54	6.54
7	10191.	.095	.136	3.70	3.70
8	15177.	.020	.037	1.50	1.50
9	20603.	.006	.014	.66	.66
	AVG ANN DMG			33.58	33.58

LOCAL PROTECTION DATA

XLPMX	XLPMN	XANCST	XDSCNT
8300.	1700.	.02300	.05040

CAPACITY=	1700.	5000.	5500.	7000.	8300.	9300.	0.	0.	0.	0.
COST=	42.	103.	149.	222.	283.	340.	0.	0.	0.	0.

MINIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY DAMAGES
1030.	0.00
1130.	0.00
1380.	1.60
1740.	2.40
2280.	5.00
3200.	7.20
4220.	9.80
4800.	11.80
5620.	13.90
6460.	16.40
7340.	20.30
8540.	23.10
10000.	28.00
12100.	34.50
15100.	44.30
21000.	50.10

MAXIMUM DESIGN DAMAGE FUNCTION

PEAK	- - - CATEGORY DAMAGES
1030.	0.00
1130.	0.00
1380.	1.60
1740.	2.40
2280.	5.00
3200.	7.20
4220.	9.80
4800.	11.80
5620.	13.90
6460.	16.40
7340.	20.30
8540.	23.10
10000.	28.00
12100.	34.50
15100.	44.30
21000.	50.10

INTERPOLATED ECONOMIC DATA FOR STATION 2030 PLAN 2

PEAK	SUM	TYPE 1
1030.	0.000	0.000
1130.	0.000	0.000
1380.	0.000	0.000
1740.	0.000	0.000
2280.	0.000	0.000
3200.	0.000	0.000
4220.	0.000	0.000
4800.	0.000	0.000
5620.	0.000	0.000
7653.	0.000	0.000
7660.	21.047	21.047
8540.	23.100	23.100
10000.	28.000	28.000
12100.	34.500	34.500
15100.	44.300	44.300
21000.	50.100	50.100

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 2030 PLAN 2

NO.	FLOW	EXCD FREQ	PROB INT	SUM	TYPE 1
1	900.	6.000	.284	0.00	0.00
2	1115.	5.462	1.752	0.00	0.00
3	1500.	3.697	1.776	0.00	0.00
4	2290.	1.769	1.072	0.00	0.00
5	3691.	.467	.705	0.00	0.00
6	5930.	.323	.391	.01	.01
7	9445.	.095	.136	3.41	3.41
8	14455.	.020	.037	1.45	1.45
9	19892.	.000	.018	.05	.05
		AVG ANN DMG		5.51	5.51
		AVG ANN BFT		20.07	20.07

UNIFORM PROTECTION LEVEL = .100

LOCAL PROTECTION CAP COST = 253. TOTAL ANNUAL = 19. DESIGN Q = 7660.

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	0	0	2	0	0	1	0	0

PREVIOUSLY GENERATED HYDROGRAPHS READ FROM TAPE
PLAN 1, RATIO 1

2.	2.	2.	3.	4.	7.	16.	31.	43.	49.
55.	58.	64.	66.	70.	76.	88.	108.	160.	250.
330.	385.	413.	450.	453.	423.	383.	333.	278.	225.
183.	154.	129.	104.	83.	64.	50.	39.	30.	23.
18.	14.	10.	8.	7.	6.	5.	5.	4.	4.
3.	3.	3.	3.	3.	3.	3.	2.	2.	2.

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINED INFLOW TO FOREBAY POOL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
30	3	0	0	0	0	1	0	0

SUM OF 3 HYDROGRAPHS AT 30 PLAN 1 RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2219.	2137.	1433.	675.	40523.
CMS	63.	61.	41.	19.	1147.
INCHES		.25	.66	.78	.78
MM		6.30	16.89	19.90	19.90
AC-FT		1060.	2844.	3351.	3351.
THOUS CU M		1308.	3508.	4133.	4133.

Exhibit 7

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HYDROGRAPH ROUTING

PROPOSED PUMPING PLANT SITE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
305	1	1	0	0	2	1	0	0

PLAN 1
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	IDVR	LSTR
0.0	0.000	0.00	1	0	0	0	0	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	400.	100000.	0.	0.	0.	0.	0.	0.	0.
OUTFLOW=	0.	1200.	1200.	0.	0.	0.	0.	0.	0.	0.

STATION 305, PLAN 1, RTIO 1

OUTFLOW

14.	14.	14.	14.	15.	17.	22.	33.	53.	81.
114.	150.	187.	225.	262.	298.	335.	374.	421.	492.
597.	735.	897.	1078.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1069.	855.
693.	546.	437.	350.	280.	225.	181.	147.	119.	97.

STOR

5.	5.	5.	5.	5.	6.	7.	11.	18.	27.
38.	50.	62.	75.	87.	99.	112.	125.	140.	164.
199.	245.	299.	359.	425.	499.	581.	665.	746.	821.
885.	939.	981.	1011.	1030.	1036.	1032.	1017.	992.	958.
916.	867.	811.	749.	681.	606.	525.	439.	356.	285.
228.	182.	146.	117.	93.	75.	60.	49.	40.	32.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	670.	40227.
CMS	34.	34.	34.	19.	1139.
INCHES		.14	.56	.78	.78
MM		3.54	14.14	19.75	19.75
AC-FT		595.	2381.	3326.	3326.
THOUS CU M		734.	2937.	4103.	4103.

MAXIMUM STORAGE = 1036.

STATION 305, PLAN 1, RTIO 2

OUTFLOW

17.	17.	17.	17.	18.	20.	26.	40.	64.	97.
137.	180.	225.	270.	314.	355.	394.	435.	489.	572.
690.	863.	1059.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1105.	870.	685.	541.	427.	338.

STOR

6.	6.	6.	6.	6.	7.	9.	13.	21.	32.
46.	60.	75.	90.	105.	118.	131.	145.	163.	191.
233.	298.	353.	429.	521.	629.	747.	869.	988.	1098.
1195.	1278.	1347.	1403.	1444.	1471.	1485.	1486.	1475.	1454.
1423.	1384.	1337.	1283.	1223.	1156.	1083.	1003.	919.	831.
740.	648.	554.	460.	366.	290.	228.	180.	142.	113.

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                                   PLAN 2
                                ROUTING DATA
           QLOSS    CLOSS     AVG    IRES   ISAME    IOPT    IPMP    IDVR    LSTR
             0.0    0.000    0.00       1       0       0       9       0       1

                    NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                        1       0       0   0.000   0.000   0.000     -1.

STORAGE=       0.     400.  100000.      0.      0.      0.      0.      0.      0.      0.
OUTFLOW=       0.    1200.    1200.      0.      0.      0.      0.      0.      0.      0.

                              PUMPING PLANT DATA
                     PMPMX   PMPMN   PMPON  PWRCST  PANCST  PDSCNT
                    10000.      0.   1500.    100.  .02300  .05040

CAPACITY=      0.     250.     500.   1000.   2000.   6000.   8000.  10000.      0.      0.
    COST=      0.     670.    1000.   1600.   2300.   6000.   7860.   8670.      0.      0.

                       STATION    305, PLAN 2, RTIO 1

                                    OUTFLOW
         14.      14.      14.      14.      15.      16.      19.      27.      40.      58.
         80.     105.     131.     159.     187.     216.     247.     280.     321.     381.
        466.     574.     697.     830.     968.    1099.    1200.    1200.    1200.    1200.
       1200.    1200.    1200.    1200.    1200.    1200.    1200.    1200.    1200.    1200.
       1200.    1200.    1200.    1200.    1150.    1036.     934.     845.     766.     696.
        634.     578.     529.     484.     444.     407.     374.     343.     315.     287.

                                     STOR
          5.       5.       5.       5.       5.       5.       6.       9.      13.      19.
         27.      35.      44.      53.      62.      72.      82.      93.     107.     127.
        155.     191.     232.     277.     323.     366.     406.     443.     480.     514.
        543.     568.     586.     600.     607.     607.     602.     592.     575.     554.
        526.     497.     462.     424.     383.     345.     311.     282.     255.     232.
        211.     193.     176.     161.     148.     136.     125.     114.     105.      96.

                                    PUMPING
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

                          PEAK   6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                 CFS     1200.    1200.     1151.      640.        38391.
                 CMS       34.      34.       33.       18.         1087.
              INCHES                .14       .53       .74           .74
                  MM               3.54     13.57     18.85         18.85
               AC-FT               595.     2285.     3174.         3174.
          THOUS CU M               734.     2818.     3916.         3916.

                       MAXIMUM STORAGE =      607.
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PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1039.	62367.
CMS	34.	34.	34.	29.	1766.
INCHES		.14	.56	1.21	1.21
MM		3.54	14.14	30.62	30.62
AC-FT		595.	2381.	5157.	5157.
THOUS CU M		734.	2937.	6361.	6361.

MAXIMUM STORAGE = 25706.

STATION 305, PLAN 2, RTIO 9

VPMP=1935416.
VOLP=2069889.

PUMPING	CAP COST	PWR COST	TOT ANN $
2457.1	2723.	94.	293.

OUTFLOW

286.	286.	287.	250.	258.	280.	333.	447.	627.	885.
1088.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.

STOR

82.	82.	82.	83.	86.	93.	111.	149.	209.	282.
363.	456.	575.	725.	903.	1112.	1363.	1674.	1889.	2302.
2998.	4027.	5397.	7136.	9258.	11716.	14428.	17276.	20135.	22895.
25479.	27884.	29972.	31851.	33480.	34865.	36025.	36986.	37770.	38399.
38893.	39273.	39556.	39757.	39890.	39965.	39996.	39990.	39956.	39899.
39676.	39740.	39643.	39535.	39419.	39295.	39165.	39028.	38886.	38739.

PUMPING

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.
2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.	2457.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1200.	1200.	1200.	1061.	63666.
CMS	34.	34.	34.	30.	1803.
INCHES		.14	.56	1.23	1.23
MM		3.54	14.14	31.26	31.26
AC-FT		595.	2381.	5264.	5264.
THOUS CU M		734.	2937.	6494.	6494.

MAXIMUM STORAGE = 39990.

EXPECTED ANNUAL FLOOD DAMAGE COMPUTATION

ISTA	NFLOD	NDMG	ISAME	TRGT	OGPRT	IAGBT	ADSCNT	AANCBT	ILPR
305	10	2	1	0.	0.000	0	0.00000	0.00000	0

ECONOMIC DATA FOR STATION 305 PLAN 1

FREQ	STOR	SUM	TYPE 1	TYPE 2
.700	1500.	0.000	0.000	0.000
.600	2390.	48.000	37.500	10.500
.450	4000.	90.000	75.000	15.000
.250	7000.	1177.500	1125.000	52.500
.100	12500.	3255.000	3150.000	105.000
.050	20000.	6052.500	5850.000	202.500
.020	28000.	7350.000	7050.000	300.000
.010	37000.	9390.000	9000.000	390.000
.005	50000.	11190.000	10650.000	540.000
.002	76000.	11835.000	11250.000	585.000

NO ADJUSTMENT OF AVERAGE ANNUAL DAMAGES FOR THIS DATA

FLOOD DAMAGES FOR STATION 305 PLAN 1

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	1036.	.700	0.000	0.00	0.00	0.00
2	1486.	.700	.152	2.02	1.58	.44
3	3587.	.480	.197	21.19	18.50	2.69
4	5904.	.311	.150	112.78	107.26	5.51
5	9557.	.169	.119	240.14	231.56	8.58
6	15876.	.075	.075	311.36	300.95	10.41
7	24937.	.030	.037	232.61	223.56	9.06
8	38699.	.009	.013	110.98	106.13	4.85
9	53876.	.004	.008	79.14	75.28	3.86
		AVG ANN DMG		1110.21	1064.81	45.40

FLOOD DAMAGES FOR STATION 305 PLAN 2

NO.	STOR	EXCD FREQ	PROB INT	SUM	TYPE 1	TYPE 2
1	607.	.700	0.000	0.00	0.00	0.00
2	882.	.700	.152	0.00	0.00	0.00
3	1554.	.480	.197	.41	.32	.09
4	1630.	.311	.150	2.00	1.56	.44
5	2654.	.169	.119	6.61	5.33	1.28
6	5603.	.075	.075	59.48	56.68	2.79
7	13184.	.030	.037	124.50	120.32	4.18
8	25706.	.009	.013	81.99	78.78	3.21
9	39996.	.004	.008	67.22	64.32	2.90
		AVG ANN DMG		342.21	327.31	14.90
		AVG ANN BFT		768.00	737.50	30.50

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 1.00	RATIO 6 1.50	RATIO 7 2.20	RATIO 8 3.25	RATIO 9 4.00
HYDROGRAPH AT	10	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	110	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	588.	666.	910.	1084.	1324.	1656.	6328.	12033.	18039.
			(	16.65)(	18.85)(	25.76)(	30.70)(	37.48)(	46.89)(	179.20)(	340.73)(	510.80)
ROUTED TO	1030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	525.	594.	839.	1005.	1252.	1574.	4949.	10079.	15369.
			(	14.87)(	16.83)(	23.76)(	28.46)(	35.47)(	44.58)(	140.13)(	285.41)(	435.19)
HYDROGRAPH AT	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
			(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
ROUTED TO	20	35.10	1	1343.	1611.	2685.	3759.	5370.	8055.	11814.	17453.	23628.
	(	90.91)	(	38.02)(	45.62)(	76.03)(	106.44)(	152.06)(	228.09)(	334.54)(	494.20)(	669.07)
			2	1346.	1549.	2023.	3096.	4717.	7408.	11178.	16833.	23026.
			(	38.12)(	43.86)(	57.29)(	87.68)(	133.56)(	209.78)(	316.53)(	476.65)(	652.02)
ROUTED TO	2030	35.10	1	941.	1139.	1940.	2921.	4312.	6699.	10191.	15177.	20603.
	(	90.91)	(	26.65)(	32.24)(	54.94)(	82.71)(	122.10)(	189.70)(	288.58)(	429.77)(	583.42)
			2	940.	1115.	1500.	2280.	3691.	5939.	9455.	14455.	19892.
			(	26.61)(	31.58)(	42.46)(	64.57)(	104.51)(	168.16)(	267.74)(	409.31)(	563.28)
HYDROGRAPH AT	30	10.00	1	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
	(	25.90)	(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
			2	453.	543.	905.	1267.	1810.	2715.	3982.	5883.	7964.
			(	12.81)(	15.38)(	25.63)(	35.88)(	51.25)(	76.88)(	112.76)(	166.57)(	225.52)
3 COMBINED	30	80.20	1	2219.	2676.	4563.	6859.	10154.	15693.	23748.	35345.	48011.
	(	207.72)	(	62.84)(	75.79)(	129.21)(	194.23)(	287.53)(	444.39)(	672.47)(	1000.86)(	1359.53)
			2	1660.	1939.	2712.	3947.	5974.	9178.	14377.	25809.	38550.
			(	46.99)(	54.90)(	76.81)(	111.75)(	169.15)(	259.89)(	407.11)(	730.83)(	1091.60)
ROUTED TO	305	80.20	1	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
	(	207.72)	(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			2	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.	1200.
			(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)(	33.98)
			PEAK STORAGES IN ACRE FEET (1000 CUBIC METERS)									
			1	1036.	1486.	3587.	5904.	9557.	15876.	24937.	38699.	53876.
			(	1278.)(	1833.)(	4424.)(	7283.)(	11788.)(	19583.)(	30760.)(	47734.)(	66455.)
			2	607.	882.	1554.	1630.	2654.	5603.	13184.	25706.	39996.
			(	749.)(	1088.)(	1917.)(	2011.)(	3274.)(	6911.)(	16263.)(	31708.)(	49334.)

SYSTEM OPTIMIZATION RESULTS

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	DIV 7	DIV 8	PMP 9	PMP 10
6701.	198.	0.	0.	0.	0.	670.	0.	2457.	0.

SYSTEM COST AND PERFORMANCE SUMMARY
(UNITS SAME AS INPUT - NORMALLY 1000'S OF DOLLARS)

TOTAL SYSTEM CAPITAL COST * * * * * * * * * * * * * * *	7408.	
TOTAL SYSTEM AMORTIZED CAPITAL COST * * * * * * * * * *	373.	
TOTAL SYSTEM ANNUAL O.M.POWER AND REPLACEMENT COST *	257.	
TOTAL SYSTEM ANNUAL COST * * * * * * * * * * * * * * *		631.
AVERAGE ANNUAL DAMAGES -- EXISTING CONDITIONS * * * *	1177.	
AVERAGE ANNUAL DAMAGES -- OPTIMIZED SYSTEM * * * * *	350.	
AVERAGE ANNUAL DAMAGE REDUCTION (BENEFITS) * * * * *		827.
AVERAGE ANNUAL SYSTEM NET BENEFITS * * * * * * * * * *		196.

***** OPTIMIZATION OBJECTIVE = MAXIMIZE SYSTEM NET BENEFITS *****

TFCST	ANFCST	ANOMPR	TANCST	ANDGWB	ANDMG	TBNFTS	NTBNFT
5034.	254.	211.	465.	1177.	601.	577.	112.

GPO 080-108/088

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
(14) Training Document, No. 9

2. GOVT ACCESSION NO.
AD-A106 702

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
(6) FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION-HEC-1 CAPABILITY. Revision,

5. TYPE OF REPORT & PERIOD COVERED

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
US Army Corps of Engineers
The Hydrologic Engineering Center
609 Second Street, Davis, CA 95616

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
(12) 210

12. REPORT DATE
(11) Sep[redacted]77

13. NUMBER OF PAGES
208

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
14 HEC-TD-9-REV

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Distribution of this publication is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

The capability described herein is included as a regular feature of the September 1981 version of HEC-1; however, the input data and output formats are different from older versions of the program.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Flood control, Systems analysis, Hydrologic systems, Model studies, Computer models, Analytical techniques, Analysis, Computer programs, Reservoirs, Diversion, Storage, Pumping plants, Economics, Hydrographs, Training, HEC-1.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document presents detailed illustrated examples of facility optimization using HEC-1. The examples were designed to assist in data assembly and coding, output interpretation, and study management. Examples included were constructed in building block sequence to illustrate the relationships between the hydrologic, economic, and cost data and to demonstrate selected capability. Examples illustrated include: (1) (1) hydrologic model for existing conditions; (2) economic evaluation
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of existing conditions; (3) optimization of reservoir and pumping plant with no hydrologic constraints; (4) optimization of reservoir and pumping plant with hydrologic performance constraints; (5) optimization of reservoir, pumping plant, and diversion (unconstrained); (6) optimization of local projects, levee and channel modification (unconstrained); (7) optimization of reservoir, pumping plant, and local protection projects with uniform local protection level. The optimization algorithm (or search procedure) discussed was developed to assist the planner in systematically and efficiently screening a large number of possible flood control alternatives. It should be emphasized that the optimization procedure of HEC-1 is a planning tool for determining potential and economically feasible flood control alternatives. Once those that have potential are selected, a more detailed simulation of the operational and hydraulic characteristics of a particular component will probably be required as various stages of study (leading to design) are undertaken.

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